FOUNDATION INVESTIGATION
PROPOSED CLUBHOUSE AND MAINTENANCE BUILDINGS
PROPOSED HONOLULU INTERNATIONAL COUNTRY CLUB
MOANALUA, OAHU, HAWAII
FOR
Y & H, INC.

DAMES & MOORE JOB NO. 8659-001-11

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DAMES & MOORE

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2875 SOUTH KING STREET · HONOLULU, HAWAII 96814 · (808) 946-1455
CABLE: DAMEMORE TELEX: 63-4100

April 13, 1976

Y & H, Inc.
c/o Robert M. Matsushita & Associates
610 Ward Avenue, Room 208
Honolulu, Hawaii 96814

Attention: Mr. Robert M. Matsushita

Gentlemen:

Supplement to Report
Foundation Investigation
Proposed Maintenance Building
- Second Relocation
Proposed Honolulu International
Country Club
Moanalua, Oahu, Hawaii

This letter presents the results of our investigation of the revised maintenance building location (2nd relocation) discussed in our proposal letter dated March 24, 1976 which was authorized by you. The building location investigated is shown on the Plot Plan, Attachment A. This location has been suggested as preferable to the previous locations (also shown) that were discussed in our previous report.*

The new site was investigated by the completion of two probes extending to depths of 42.5 feet and 41.0 feet. Probe locations are shown on the Plot Plan, designated as Probe A and B. Logs for these probes are presented on Attachment B. The probes were conducted to determine the thickness of fill over the highly compressible lake mud which underlies the site. Probes were completed by augering through the fill and by driving a standard split spoon through the lake mud to the lake bottom. The split spoon was driven with a 140 pound hammer dropping 30 inches. Soil samples were not taken.

*See our report: "Foundation Investigation, Proposed Clubhouse and Maintenance Buildings, Proposed Honolulu International Country Club, Moanalua, Oahu, Hawaii, For Y & H, Inc." dated November 18, 1975.

The conditions encountered are consistent with the conditions disclosed in our previous borings in this immediate area (presented in our November 18, 1975 report). The fill layer is on the order of 15 to 17 feet thick, overlying 21 to 22 feet of soft lake mud. However, due to the relatively limited nature of this investigation and the large size of the proposed building, we anticipate that there may be some variations in the thickness of the fill and/or the soft material underlying the site.

Based on the data developed, it is our opinion that the maintenance facility may be constructed as discussed in our previous report (and repeated here for convenience). The building should be set back at least five feet from the edge of the existing slope. Spread foundations may be used with a maximum allowable bearing pressure of 3000 psf for foundations embedded two feet below the lowest adjacent grade. Other design recommendations presented in our previous report are applicable.

We anticipate that differential settlement on the order of one to three inches will occur across the width of the structure. Since the conditions along the length of the structure appear to be consistent, it is likely that settlement across the building length will not be substantial. However, due to the fact that no drilling was done along the south side of the structure, and that no rigorous settlement analysis was conducted, a variability in the actual conditions is not precluded. A differential settlement of perhaps one inch in sixty feet may be reasonable to anticipate. We recommend that provision be made at each column to relevel the building if this movement cannot be tolerated. It is our understanding that it is more desirable for you to use a concrete floor slab for this structure rather than the flexible asphalt slab which we recommended previously. If a concrete slab is used, it is recommended that joints be provided in the slab to allow for relative movement of adjacent slab panels. We anticipate that cracking of the slab may occur, and may require periodic patching.

We request that this letter be bound in your copies of our November 18, 1975 report.

We trust that the information presented herein is suitable for your needs. Should you have any further questions, please contact us.

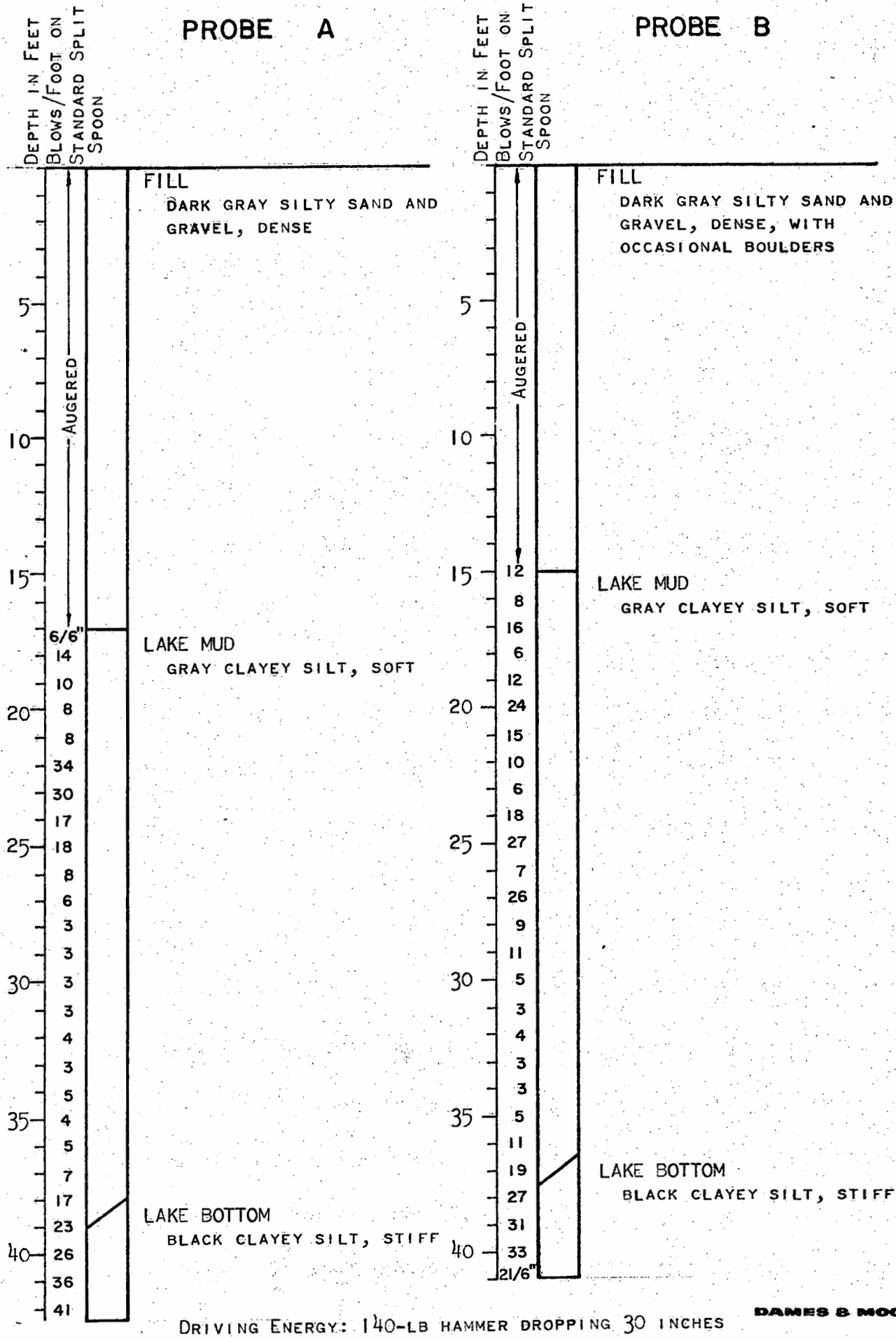
Yours very truly,

DAMES & MOORE

Howard Schirmer, Jr.

HAS:CCF:cfa
(Five copies submitted)
Attachments: Attachment A, Plot Plan
Attachment B, Log of Probes; Probe A and B

LOG OF PROBES



DRIVING ENERGY: 140-LB HAMMER DROPPING 30 INCHES

DAMES & MOORE

ATTACHMENT B

REVISIONS BY DATE

FILE 8659-001

BY MB DATE 4.9.76

CHECKED BY CCF DATE

946 REV.

ANCHORAGE
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November 18, 1975

Y & H, Inc.
c/o Robert M. Matsushita & Associates
610 Ward Avenue, Room 208
Honolulu, Hawaii 96814

Attention: Mr. Robert M. Matsushita

Gentlemen:

Five copies of our report "Foundation Investigation, Proposed Clubhouse and Maintenance Buildings, Proposed Honolulu International Country Club, Moanalua, Oahu, Hawaii, for Y & H, Inc." are herewith submitted.

The scope of our work was defined in our proposal dated August 29, 1975, and this foundation investigation has generally conformed to the scope described in that proposal. However, in our meeting with you and the owner on October 6, 1975, we presented a letter stating our preliminary recommendations. We recommended moving the clubhouse in from the existing slope and shifting the maintenance building to another area with better soils. As agreed, three additional borings were drilled at the new maintenance building location. A letter dated October 14, 1975 was submitted to further describe our recommendations for the clubhouse and maintenance buildings and also present the scope of our additional investigation.

We were notified by Mr. Kenneth Inada of Robert M. Matsushita & Associates, on October 29, 1975, that a surveying error has been uncovered in the area of the clubhouse entrance driveway. A recent survey showed that the north slope had not been filled out as far into the lake as originally shown on the topographic map. Additional recommendations to fill this area are contained in the body of this report. For convenient reference, a summary of recommendations is given on the first page.

Selected soil samples were used in laboratory testing, and the remaining ones will be kept for a period of time for possible inspection and examination. Unless requested otherwise, they will be discarded six months from this date.

It has been a pleasure performing this assignment for you. If you have any questions regarding this report, please feel free to contact us for clarifications.

Yours very truly,

DAMES & MOORE

Howard Schirmer

Howard Schirmer, Jr.

HAS:MAY:pdc

FOUNDATION INVESTIGATION

PROPOSED CLUBHOUSE AND MAINTENANCE BUILDINGS

PROPOSED HONOLULU INTERNATIONAL COUNTRY CLUB

MOANALUA, OAHU, HAWAII

FOR

Y & H INC.

SUMMARY

The borings indicate the site of the proposed clubhouse is underlain by 38 feet of volcanic tuff fill and a thin layer of soft compressible silt mixed with volcanic tuff gravel. Our observations and calculations indicate that areal settlement due to the present weight of the fill has ceased. Therefore, the clubhouse building may be supported on spread foundation designed for maximum bearing pressure of 3,000 pounds per square foot provided it is located ten feet from the proposed edge of slope. Ten feet of additional fill is needed to grade the entrance driveway of the clubhouse area. This fill should be placed a minimum of three months prior to construction of the building so that the settlement created by the fill weight would have minimal affects on the building. We estimate that the total settlement of the building foundations would range from 1 to 1½ inches. Differential settlement of about ½-inch may occur between footings. Basement retaining walls may be designed for an equivelent fluid pressure of 40 pounds per square foot per foot of depth if adequate drainage is provided to prevent buildup behind the wall. The additional fill in Lake No. 1 for the clubhouse entrance driveway should bear on the medium-stiff to stiff clay to prevent potential slope instability. The exposed organic silt crust should be excavated before placing displacement fills.

The borings indicate that the originally proposed maintenance building site is underlain by varying thicknesses of fill over very soft compressible silt. Due to the large variations in thickness of the compressible soil and the weight of additional fill yet to be placed, differential settlements of 12 to 18 inches could be expected during the life of the building. Pile foundations would be needed if the building is to be constructed at the originally proposed location. Building relocation is recommended to avoid a pile foundation. Three additional borings drilled at the second site indicated that the building could be supported on spread foundations similar to that proposed for the clubhouse. Differential settlement of one to three inches may occur across the width of the building.

More detailed recommendations are presented in the body of the report.

INTRODUCTION

This report summarizes the results of our foundation investigation performed for the proposed clubhouse and maintenance buildings at the proposed Honolulu International Golf Course located in Moanalua, Oahu, Hawaii.

The building sites are located along the north end of the proposed golf course. The approximate location of the facilities is shown on the Map of Area, Plate 1. The proposed building locations are shown in greater detail on the Plot Plan, Plate 2.

PROJECT CONSIDERATIONS

It is our understanding that the proposed clubhouse building will be a two-story concrete frame structure with hollow-tile block walls. The building will have approximate dimensions of 195 feet long by 160 feet wide. The column

total loads are estimated to be a maximum of 240 kips with average interior column total loads of about 175 kips. Total wall loads would be about 25 kips per linear foot. The ground floor would be constructed at elevation +13 Mean Sea Level (MSL) which would require approximately two feet of excavation in the building area. To construct a driveway to the entrance, approximately 10 feet of fill will be placed on the north side the building. Basement retaining walls will be required around the west, north, and east sides of the building.

The maintenance building will be located at the eastern end of the proposed parking lot area. The floor of the building will be constructed at elevation +14 MSL and will require raising the present area by two to three feet. Originally, the building was to be approximately 145 feet long and 50 feet wide and situated 40 feet in from the edge of the proposed golf course. However, the two borings drilled at this location indicated that large differential settlements could occur if the building was constructed in that location as originally planned. In our meeting on October 6, 1975 with the owner, it was decided to relocate the building, adjacent to the edge of the proposed golf course on a former dike. The building was also reduced in width to 40 feet and lengthened to 160 feet. The building would be a steel frame structure with column total loads of approximately 9 kips. The building is to be mainly used

for the maintenance of the golf course vehicles and large mounds of fertilizer will not be stored in this area. The parking lot is to be graded to elevation +12 MSL and paved.

PURPOSE AND SCOPE OF WORK

The purpose of this investigation was to explore the subsurface conditions at the building sites and to make recommendations for earthwork, foundation, and parking lot pavement design. Specifically, the scope of our work consisted of the following:

1. The drilling of four borings within the proposed clubhouse site, two borings within the original maintenance building site, and three additional borings at the relocated maintenance building site;
2. Performance of laboratory tests on selected soil samples to determine the general engineering properties of the soils;
3. Development of recommendations for earthwork and design of the building foundation and parking lot pavement based on the results of our field investigation, laboratory testing, and engineering analysis; and
4. Compilation of the results of our investigation into the form of a bound report.

SITE CONDITIONS

PRIOR HISTORY

The building sites were constructed within the limits of the original lake. Our preliminary investigation for the proposed golf course indicated that the sites were originally underlain by 10 to 30 feet of soft silt overlying a stiffer clay. In 1969, the sites of the proposed clubhouse and parking lot were filled.

The parking lot was constructed to utilize as much of the soft lake silt as possible. During construction, two dikes were constructed on the north and south edges of the parking lot to trap the silt between the dikes. Volcanic tuff fill was placed over the trapped silt. The area was initally graded to elevation +12 MSL. Since 1969, the fills over the soft silt have settled about four feet and the dike areas have settled about six inches. Settlement Gage No. 147 placed in the parking area indicated that the area was still settling in 1974, five years after construction.

The clubhouse area, at the west end of the parking lot, was filled with the intention of displacing of the soft lake silt and having the fill bear on the stiffer underlying clay. To displace the silt, the fill was ramped up, and large mud waves were created around the tip of the fill. This area was filled to elevation +15 MSL at the end of construction, and the peripheral edges of the site were surcharged with a five-foot fill. During construction in

1969, settlement gauges were installed and they indicated that a maximum 5.3 inches of settlement occurred in this area, as of January 1971. These gages also indicated that settlement essentially ceased in the clubhouse area. A summary of this settlement monitoring is contained in Appendix C.

PRESENT SURFACE CONDITIONS

During the construction of the golf course, the clubhouse and parking areas were used to dry excavated silty lake sediments. The silt which had been stockpiled in the clubhouse area has been removed and the surface has been graded to about elevation +15 MSL. At the time of our field investigation, stockpiles of semi-dry silt were located on the north edge of the proposed parking lot. These stockpiles were later removed from the site. The surface of the parking lot contained large depressions approximately three to four feet deep. The contractor filled these depressions with uncompacted brown sandy silt.

SUBSURFACE CONDITIONS

Clubhouse - Borings drilled in the clubhouse area indicate that the site is underlain by approximately 38 feet of volcanic tuff fill consisting of rock fragments ranging in size from sand to boulders. According to our

records, the upper six feet of the fill was compacted to 90 percent of the maximum density (ASTM D-1557) during the initial filling in 1969. At that time, the lake water level was at elevation +6 MSL. The lower portion of the fill was placed below water, and received no mechanical compaction. The borings indicate that the uncompacted material varies from loose to medium dense. At approximately 38 feet below the surface, a one- to two-foot thick zone of mixed fill material and soft silt was found. Medium stiff to stiff silty clay was encountered below a depth of 40 feet.

Maintenance Building - The borings in the vicinity of the maintenance building indicate that the fill thickness varies substantially. In Boring 5, situated toward the west end of the original building location, approximately 10 feet of volcanic tuff fill was encountered overlying 25 feet of very soft organic clayey silt. Below the soft silt, medium stiff to stiff silty clay was encountered. The silty clay graded stiffer with depth.

In Boring 6, located at the east end of the original building location, approximately 22 feet of fill was encountered overlying a six-foot thick layer containing a mixture of the soft silt, volcanic cinders, and tuff fragments. Between a depth of 28 to 34 feet, a soft sandy clayey silt was encountered. Medium stiff to stiff silty clay was encountered at a depth of 34 feet.

Borings 7, 8, and 9, were drilled on the north edge of the new relocated building site to determine the extent of the original construction dike. At Boring 7, approximately 17 feet of fill was encountered overlying a layer approximately four feet thick, composed of a mixture of fill and soft silt. Thirteen feet of soft silt was encountered below the mixed soil layer and was underlain by stiff silty clay. At Boring 8, 32 feet of fill was encountered overlying the medium stiff to stiff silty clay. No soft soil was encountered at this location. Boring 9 revealed 30 feet of fill overlying 3 feet of medium stiff silt. Stiff silty clay was also found at a depth of 33 feet.

Water was encountered at approximately elevation +3 MSL in all borings. The locations of the borings are shown on the Plot Plan. The boring logs with a more detailed discussion of the field investigation is contained in Appendix A.

DISCUSSIONS AND RECOMMENDATIONS

PROPOSED CLUBHOUSE

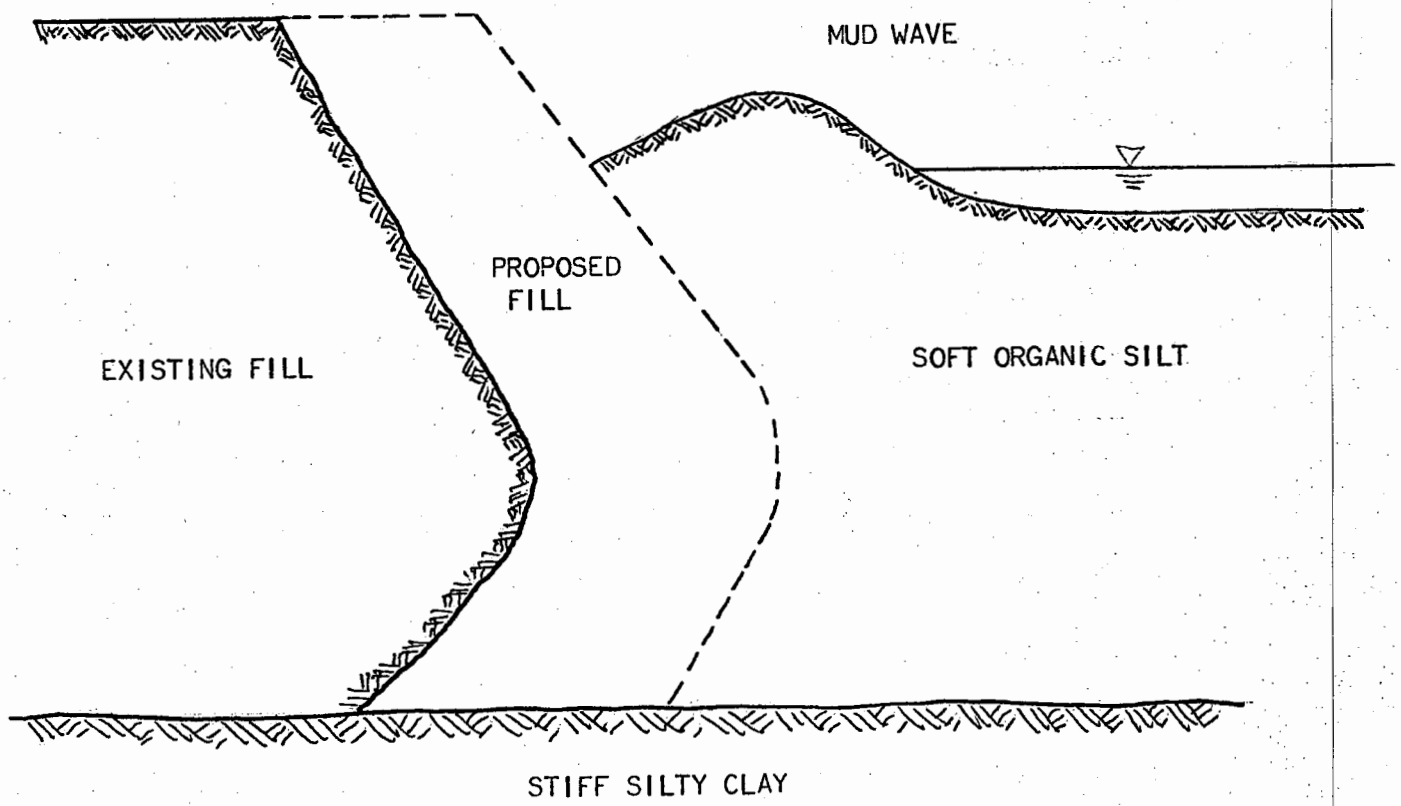
Earthwork - An additional ten feet of compacted fill is to be placed at the entrance of the building to be located on the north side of the structures. We recommend that the proposed fill be placed a minimum of three months prior to the building construction since we anticipate that some settlement would occur due to the weight of the new

fill. The fill should be placed in 8-inch loose lifts and compacted to 90 percent of the maximum density as determined by the modified compaction test procedure ASTM D-1557. The fill should extend 10 feet laterally into the proposed building limits. Three feet of loose soil should be placed temporarily on the top of the compacted fill, as a surcharge to accelerate the settlement. The approximate surcharge extent is shown on Plate 3. The on-site material excavated from the lower level of the building would be suitable as fill material provided boulders in excess of 8 inches in maximum dimensions are removed.

Additional fill will have to be placed on the north edge of the proposed clubhouse site, to accomodate the proposed driveway. An area approximately 15 feet wide will have to be constructed out from the existing edge. This area is shown on the Plot Plan.

Presently, a dried mud flat exists at the toe of the slope. The silt underlying the dried mud crust is very soft. To construct a stable slope, the silt will have to be displaced from beneath the fill. Displacement will create a mud wave which will likely extend into the existing lake. This mud wave may not be aesthetically desirable. Therefore, we recommend that the soft silt be excavated from the fill area to as deep a depth as possible prior to filling, to reduce the volume pushed out into the lake. The excavation

should allow the fill to sink down to stiffer underlying soil. The mud may be excavated with a clamshell or drag line equipment. After the excavation, the fill below the water level and up to two feet above the water level, may be placed uncompacted. The remaining fill should be compacted to the levels previously described and the surcharge placed. A diagram showing the existing and proposed slope is illustrated below.



Foundation and Retaining Wall Design - Due to the anticipated loose fill on the existing slope, we recommend that the building be located six feet from the existing slope. The foundations for the building may be designed for maximum bearing pressure of 3000 pounds per square foot provided they are founded 24 inches below the adjacent grade. A one-third increase in bearing pressure is allowable for temporarily applied live loads.

During construction, two feet of the surface fill is to be excavated to reach the finished floor level. The foundations will be placed two feet below the finish floor elevation. Therefore, we anticipate that the foundations would be bearing on a minimum of two feet of previously compacted fill and 32 feet of uncompacted fill. Total settlement of about 1 to 1½ inches may occur due to the uncompacted fill and the large proposed column loads. However, the majority of the settlement should occur during construction. Differential settlement of about ½-inch may occur between adjacent footings.

We recommend proof rolling the area with a large vibratory compactor after excavation to the first floor subgrade prior to excavating foundations to densify underlying fill materials. Also, the base on each foundation excavation should be tamped and inspected by a soil engineer prior to pouring of concrete.

It is our understanding that the exterior walls of the basement would be fairly rigid and non-yielding. Therefore, we recommend that the walls be designed for an equivalent fluid pressure of 40 pounds per square foot per foot of depth. Surface drainage should be planned to channel the rain runoff away from the building and subdrains should be installed at the base of the retaining walls to prevent possible hydrostatic pressure on the wall.

A coefficient of sliding friction of 0.55 may be used to calculate the frictional resistance beneath the base of retaining wall and building foundations. A passive pressure of 250 pounds per square foot per depth may be used to resist the lateral thrust of retaining wall and building foundations. The surface foot of soil should be neglected in the passive pressure calculations.

Slabs On-Grade - Slabs may be supported on-grade if a minimum of four inches of granular fill such as No. 3 fine gravel, is placed beneath the slab as a capillary break. The volcanic tuff gravel should not be used since it contains fines. A moisture-barrier should also be included in areas which would be habitable.

PROPOSED MAINTENANCE BUILDING

Our laboratory tests indicate that the soft clayey silt in the area of Boring 5 may be presently consolidating under the weight of the existing fill and the additional

fill would accelerate and increase the total settlement. We estimate that the proposed maintenance building constructed at the original location 40 feet in from the edge of the golf course would undergo settlement of about 12 to 18 inches on the west corner. However, we estimate that the south and east sides of the building near Borings 6, 7, 8, and 9 will settle about 1 to 3 inches. Therefore, to avoid the large differential settlements, we recommend that the building be relocated to a better site or supported on pile foundations.

To avoid the expense of a pile foundations, we understand that the building can be moved to the south over the location of the original dike as previously recommended. The building should be set back five feet from the edge of the existing slope. The building, if constructed at the new location, could be supported on spread foundations design for maximum bearing pressure of 3000 pounds per square foot provided the foundations are embedded two feet below the exterior grade. Design recommendations presented for the clubhouse would be applicable.

Differential settlement would occur across the building due to the differences in soft compressible silt thickness underlying the site. The maximum settlement of one to three inches would occur in the area around Boring 7. We anticipate minimal settlements would occur at the other

three corners of the building where little or no soft silt was encountered. A differential settlement of one to three inches should be expected across the width of the building.

Provisions should be made at the columns to relevel the building if this settlement cannot be tolerated. Slabs could be supported on grade if constructed of asphaltic concrete. The slab construction should consist of six inches of compacted base course and three inches of asphaltic concrete. Future repaving might be necessary.

PROPOSED PARKING LOT

Our investigation tests in the vicinity of the proposed maintenance building indicates that the parking area may be still settling under the weight of the fill placed in 1969. We would recommend that central area be crowned about two feet to compensate for settlement. As an alternate, a drainage system could be constructed to allow for removal of ponded water from the central area.

We anticipate that the parking lot area will have to be regraded prior to construction. Approximately three to four feet of loose uncompacted fill has been placed within the existing depressions in the proposed parking lot to level the area to about elevation +12. We would recommend that two feet of the surface loose fill be removed and compacted to reduce settlement within the loose fill and

improve load carrying capacity. The material removed from the depressed areas could be used as fill. The fill should be spread in eight-inch loose lifts and compacted to 90 percent of the maximum dry density. The final six inches of the pavement subgrade should be compacted to 95 percent of the maximum dry density. The parking lot pavement may be designed using two inches of asphaltic concrete and six inches of compacted granular base course. The asphaltic concrete and base course should be conform to the City & County of Honolulu stardard specifications.

PROPOSED UTILITY SYSTEMS

We recommend that the major utility lines be located along or beneath the proposed main entrance road on the north edge of the parking lot, since it is situated over a former construction dike. We do not anticipate that differential settlements will occur in this area which may damage the lines. Weldo anticipate differential settlements within the central portion of the parking lot and recommend that flexible conduits be installed in this area.

LIMITATIONS AND INSPECTION

This report has been prepared in accordance with generally accepted soil foundation engineering practices. No other warranty expressed or implied is made as to the professional advice included in this report. The report has

not been prepared for use by parties other than the owners, the designer, and structural engineer. It may not contain sufficient information for purposes of other parties or for other uses.

It is recommended that construction plans and specifications be reviewed by us to verify that the intent of these recommendations are included. In addition, a provision should be made for inspection of the fill construction and foundation excavations by a qualified soils engineer. Such inspection would provide an opportunity to modifiy the design recommendations in the event that conditions vary significantly from those disclosed during our subsurface investigation.

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The following Plates and Appendices are attached and complete this report.

Plate 1	Map of Area
Plate 2	Plot Plan
Plate 3	Proposed Clubhouse Fill
Appendix A	Field Exploration and Laboratory Testing
Appendix B	Summary of Density Tests
Appendix C	Summary of Settlement Observations, Letter No. 161

Respectfully submitted,

DAMES & MOORE

Howard Schirmer

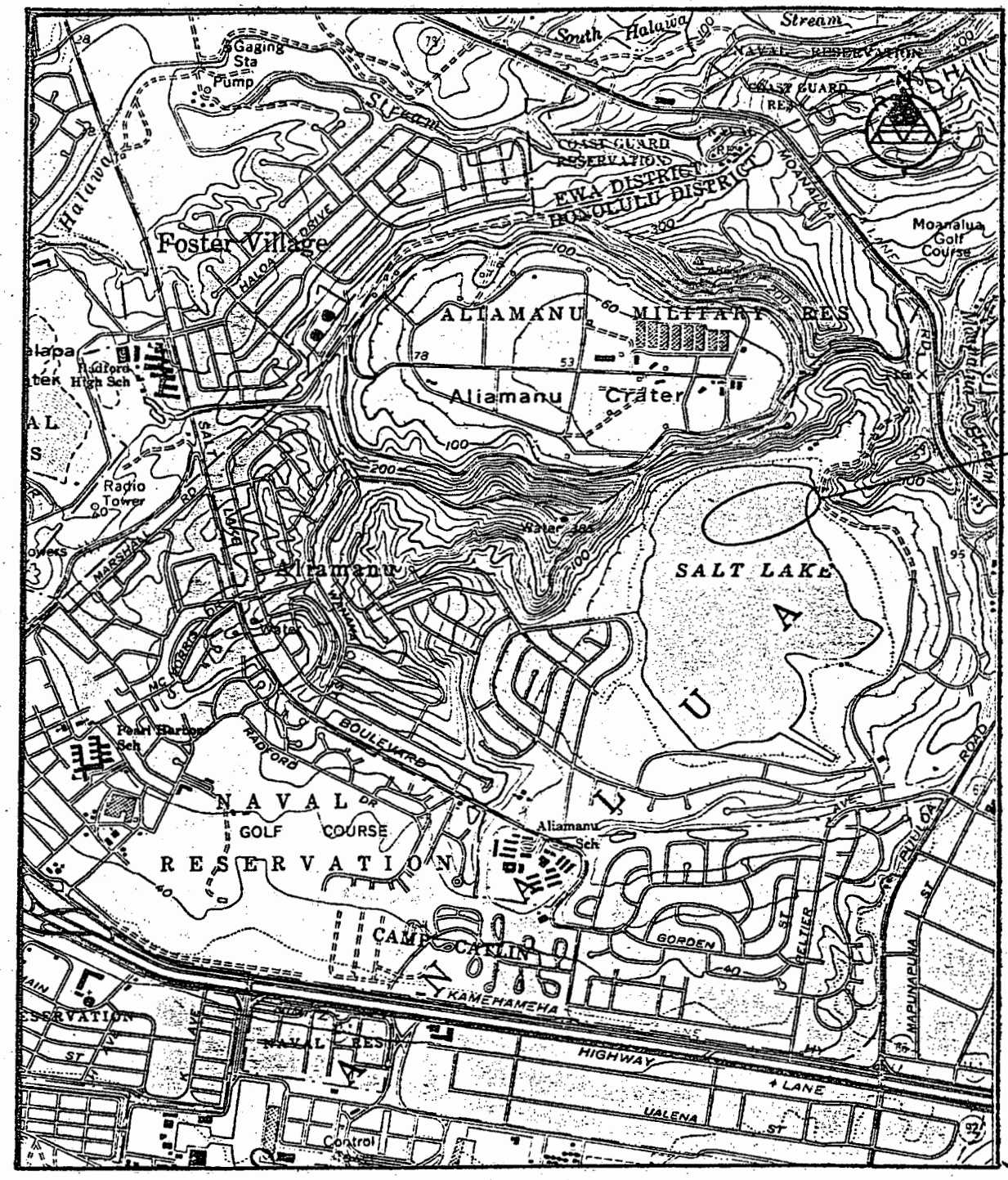
Howard Schirmer, Jr.

HOWARD SCHIRMER, JR. REGISTERED PROFESSIONAL ENGINEER No. 2228 HAWAII, U.S.A.

THIS WORK WAS PREPARED BY ME OR UNDER MY SUPERVISION.

Howard Schirmer

CUSS NO. 47922



MAP OF AREA

SCALE 1:24000

1 MILE

7000 FEET

1 KILOMETER

REFERANCE:
U.S.G.S. QUAD.
PUULOA, HAWAII
DATED 1968

DAMES & MOORE
PLATE 1

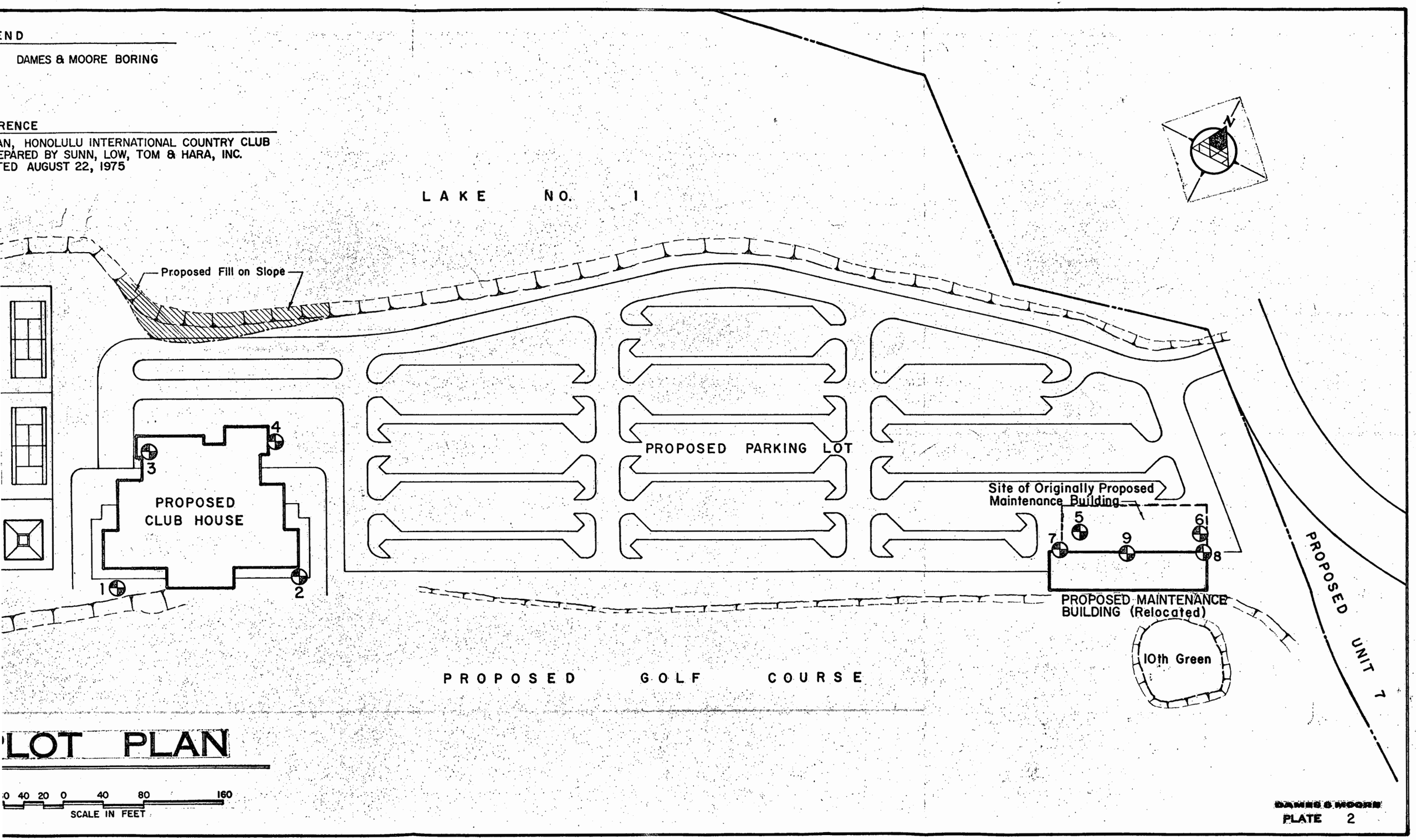
BY____ DATE____
CHECKED BY____
FILE____

END

DAMES & MOORE BORING

RENCE

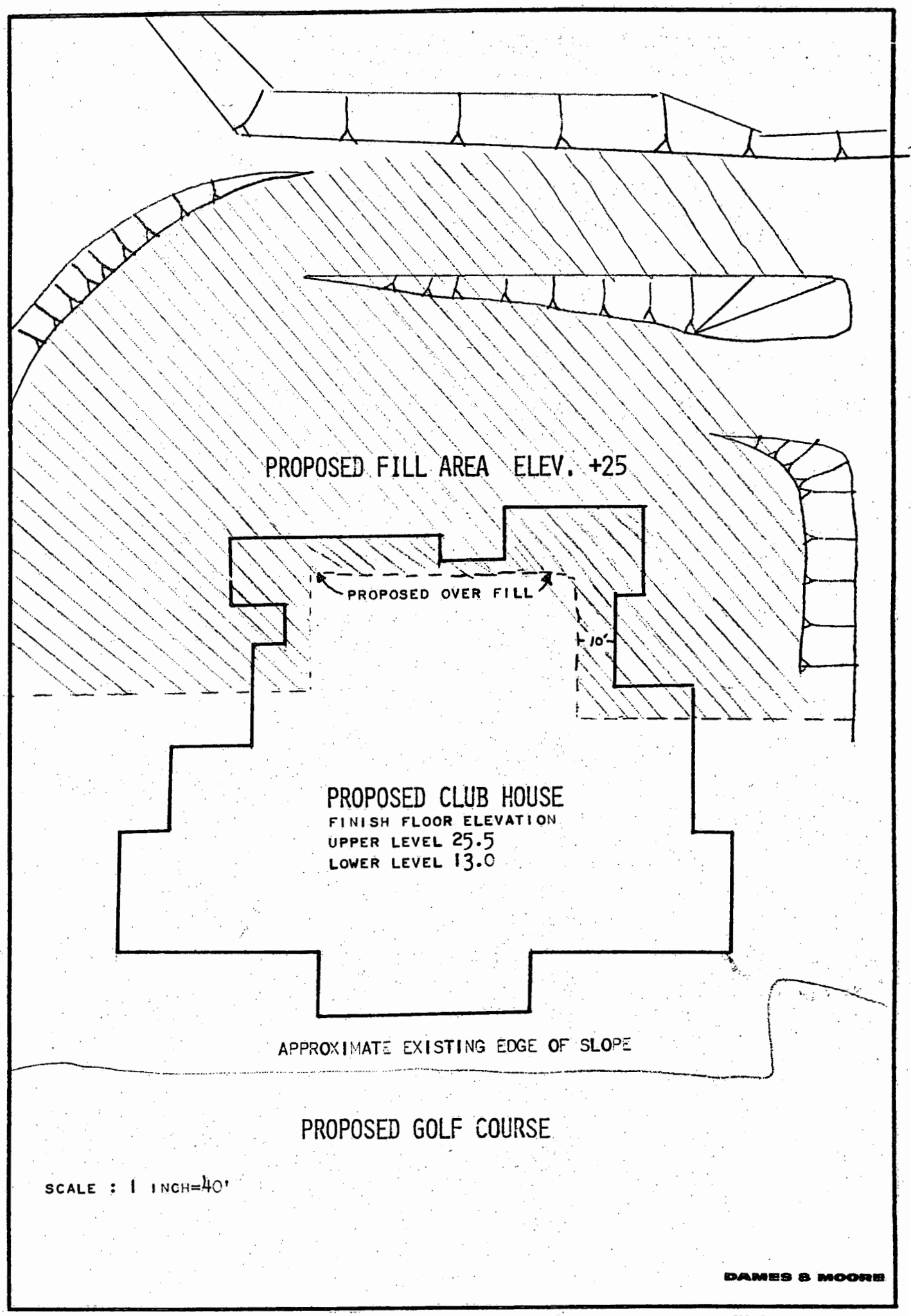
AN, HONOLULU INTERNATIONAL COUNTRY CLUB
EPARED BY SUNN, LOW, TOM & HARA, INC.
TED AUGUST 22, 1975



LOT PLAN

0 40 20 0 40 80 160
SCALE IN FEET

DAMES & MOORE
PLATE 2



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DAMES & MOORE

PLATE 3

APPENDIX A

FIELD EXPLORATION AND LABORATORY TESTING

FIELD EXPLORATION

The field exploration of the site was conducted on September 4 to September 10, 1975 and October 10 and 14, 1975. A total of nine borings were drilled at the site to explore the subsurface soil conditions. Four borings were drilled at the proposed clubhouse site and five borings were drilled at the proposed maintenance building sites. Borings 1 and 5 were drilled to a depth of 41.5 feet; Boring 2 was drilled to 45.0 feet; Boring 3 was drilled to 46.5 feet; Boring 4 was drilled to 44.1 feet; Boring 6 was drilled to 40.5 feet; and Borings 7 and 9 were drilled to 34.5 feet; and Boring 8 was drilled to 35.0 feet. The locations of the borings are shown on the Plot Plan, Plate 2. The borings were advanced using a truck-mounted rotary drill rig. The field operations were conducted under the technical supervision of one of our engineers who sampled and classified the various materials encountered in the borings. Samples in the borings were obtained using a Dames & Moore underwater sampler driven with a 300-pound hammer falling 30 inches.

The equipment used to obtain samples in the borings is illustrated on Exhibit A-I. The subsurface conditions encountered during the drilling operations are shown on the Log of Borings, Plate A-IA through A-II. The method of categorizing the soils is presented on Plate A-2, Unified Soils Classification System.

LABORATORY TESTING

To study the engineering properties of the soils encountered, identification, consolidation and moisture density determinations were performed on selected soil samples. Descriptions of each test are contained in the following paragraphs.

IDENTIFICATION TESTS

To help classify the soils encountered, Atterberg Limits determinations were performed on several samples. The results of the Atterberg Limits determinations are listed below:

Boring (No.)	Depth (ft.)	Soil Type	Liquid Limit	Plasticity Index
1	40.5	MH - OH	103.8	65.8
2	39.0	MH - OH	105.0	62.0
3	45.5	CH	69.0	32.4
5	14.0	MH - OH	13.0	75.3

Consolidation Tests - Two consolidation tests were performed on samples of the compressible material from Boring 2 at a depth of 39 feet and Boring 5 at a depth of 14 feet. The method of performing this test is described on Exhibit A-2. The ploted curves representing the consolidation test data are presented on Plates A-3A and A-3B, Consolidation Test Data.

Moisture-Density Determinations - Moisture-density tests were made on most of the samples to correlate the vertical and horizontal variations with the engineering characteristics of the subsoils. The results of these tests are presented on the Log of Borings.

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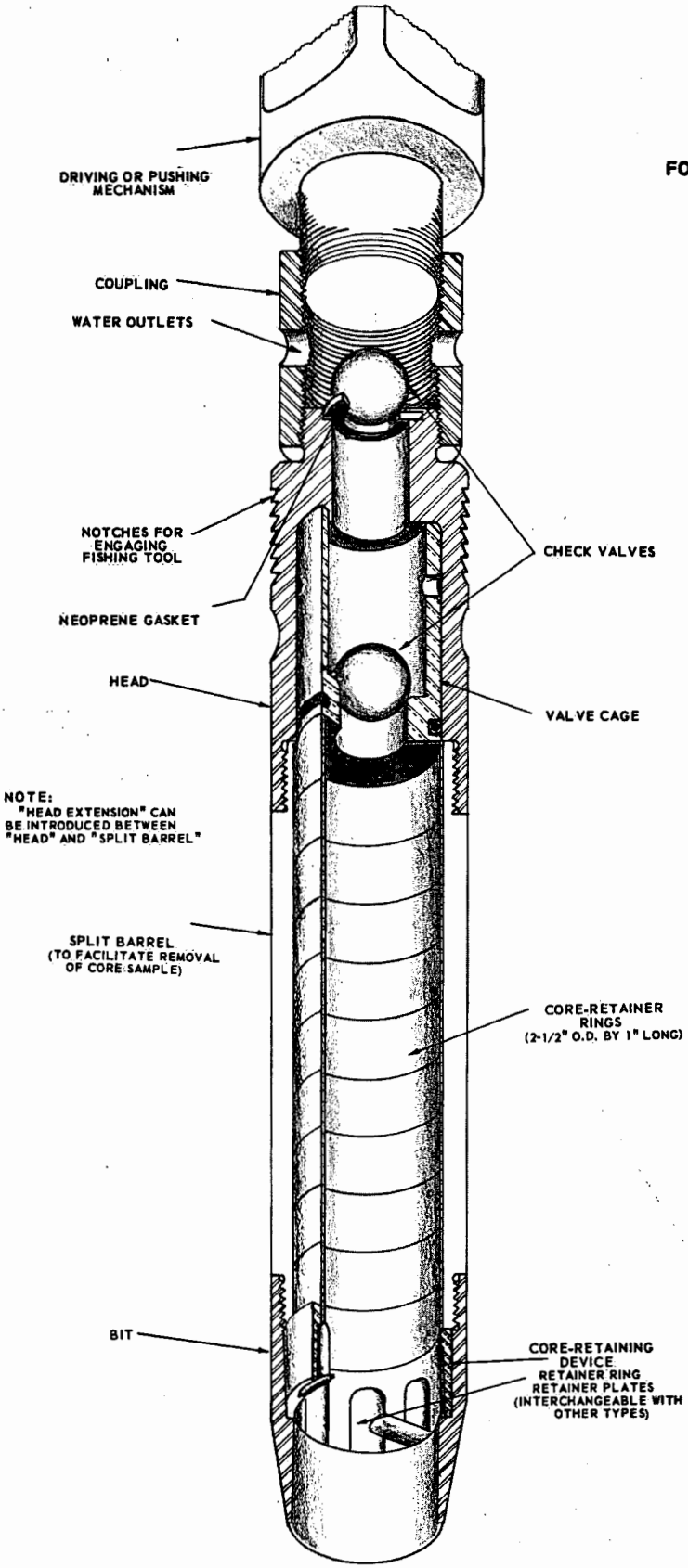
The following Exhibits and Plates are attached and complete this Appendix.

Exhibit A-1	Dames & Moore Soil Sampler, Type U
Exhibit A-2	Method of Performing Consolidation Tests
Plate A-1A	Log of Borings, Boring 1
Plate A-1B	Log of Borings, Boring 2
Plate A-1C	Log of Borings, Boring 3
Plate A-1D	Log of Borings, Boring 4
Plate A-1E	Log of Borings, Boring 5
Plate A-1F	Log of Borings, Boring 6
Plate A-1G	Log of Borings, Boring 7
Plate A-1H	Log of Borings, Boring 8
Plate A-1I	Log of Borings, Boring 9

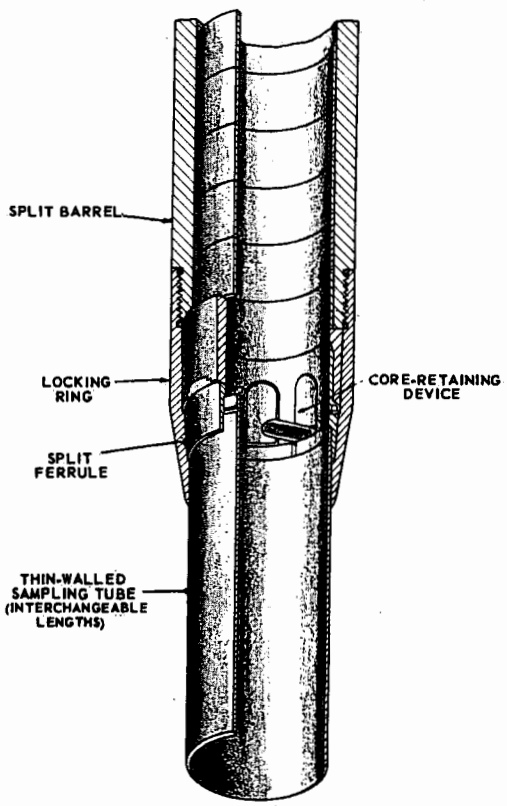
Plate A-2	Unified Soil Classification System
Plate A-3A	Consolidation Test Data, Boring 2
Plate A-3B	Consolidation Test Data, Boring 5

SOIL SAMPLER TYPE U

FOR SOILS DIFFICULT TO RETAIN IN SAMPLER



ALTERNATE ATTACHMENTS



417.9 (5-68)

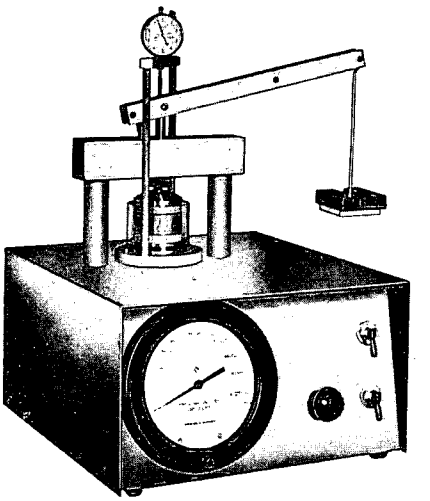
DAMES & MOORE

Exhibit A-1

METHOD OF PERFORMING CONSOLIDATION TESTS

CONSOLIDATION TESTS ARE PERFORMED TO EVALUATE THE VOLUME CHANGES OF SOILS SUBJECTED TO INCREASED LOADS. TIME-CONSOLIDATION AND PRESSURE-CONSOLIDATION CURVES MAY BE PLOTTED FROM THE DATA OBTAINED IN THE TESTS. ENGINEERING ANALYSES BASED ON THESE CURVES PERMIT ESTIMATES TO BE MADE OF THE PROBABLE MAGNITUDE AND RATE OF SETTLEMENT OF THE TESTED SOILS UNDER APPLIED LOADS.

EACH SAMPLE IS TESTED WITHIN BRASS RINGS TWO AND ONE-HALF INCHES IN DIAMETER AND ONE INCH IN LENGTH. UNDISTURBED SAMPLES OF IN-PLACE SOILS ARE TESTED IN RINGS TAKEN FROM THE SAMPLING DEVICE IN WHICH THE SAMPLES WERE OBTAINED. LOOSE SAMPLES OF SOILS TO BE USED IN CONSTRUCTING EARTH FILLS ARE COMPACTED IN RINGS TO PREDETERMINED CONDITIONS AND TESTED.



DEAD LOAD-PNEUMATIC CONSOLIDOMETER

IN TESTING, THE SAMPLE IS RIGIDLY CONFINED LATERALLY BY THE BRASS RING. AXIAL LOADS ARE TRANSMITTED TO THE ENDS OF THE SAMPLE BY POROUS DISKS. THE DISKS ALLOW DRAINAGE OF THE LOADED SAMPLE. THE AXIAL COMPRESSION OR EXPANSION OF THE SAMPLE IS MEASURED BY A MICROMETER DIAL INDICATOR AT APPROPRIATE TIME INTERVALS AFTER EACH LOAD INCREMENT IS APPLIED. EACH LOAD IS ORDINARILY TWICE THE PRECEDING LOAD. THE INCREMENTS ARE SELECTED TO OBTAIN CONSOLIDATION DATA REPRESENTING THE FIELD LOADING CONDITIONS FOR WHICH THE TEST IS BEING PERFORMED. EACH LOAD INCREMENT IS ALLOWED TO ACT OVER AN INTERVAL OF TIME DEPENDENT ON THE TYPE AND EXTENT OF THE SOIL IN THE FIELD.

466.12 (4-64)

FILE 8059-001
BY kb DATE 9-15-75
CHECKED BY MV DATE 9-15-75

REVISIONS
BY DATE
BY DATE
PLATE OF

BORING 1

SURFACE ELEVATION +15 FEET
MSL DATUM

Moisture Content in %	Dry Density in PCF	Blows/Ft. on Sampler	Core and % Recovery	Samples and/or Cores	Depth in Feet	Graph Symbol	Letter Symbol	Description
							GW-GP	BROWN SANDY TUFF GRAVEL, COBBLES AND BOULDERS (DENSE) COMPACTED FILL
14.7	104	27		■				
12.8	107	22		■	5		OH	LENS OF GRAY ORGANIC SILT
16.4	85	5		■				END OF COMPACTED FILL LAYER
18.5	103	13		■				GRADES TO MEDIUM DENSE TO LOOSE (UNCOMPACTED FILL)
					10			▽ WATER LEVEL AT 0720 HOURS ON 9-5-75
20.0	103	11		■				
					15			
		50/6"		■				
		20/1"		▣	20			
					25			
18.8	114	20		■				
					30			
					35			
16.1	119	30		■				
29.8	93	27		■			OH-GM	GREENISH GRAY ORGANIC SILT AND TUFF SAND AND GRAVEL (SOFT AND LOOSE)
38.1	86	39		■	40		CH-MH	GREENISH GRAY SILTY CLAY (STIFF)
								BORING COMPLETED AT 41.5 FEET ON 9-4-75

LOG OF BORINGS

NOTES:

■ -DEPTH AT WHICH UNDISTURBED SAMPLE WAS TAKEN
⊠ -DEPTH AT WHICH DISTURBED SAMPLE WAS TAKEN
□ -DEPTH AT WHICH SAMPLE WAS LOST DURING EXTRACTION
I -DEPTH AND LENGTH OF CORE RUN
DRIVING ENERGY- 300 -LB WEIGHT DROPPING 30 INCHES

DAMES & MOORE

PLATE A-1A

466.12 (4-64)

FILE 8659-001
BY AK DATE 9-24-75
CHECKED BY MY DATE 9-24-75

REVISIONS
BY DATE
BY DATE
PLATE OF

BORING 2

SURFACE ELEVATION +14.9 FEET
MSL DATUM

Moisture Content in %	Dry Density in PCF	Blows/Ft. on Sampler	Core and % Recovery	Samples and/or Cores	Depth in Feet	Graph Symbol	Letter Symbol	Description
							GW-GP	BROWN SANDY TUFF GRAVEL, COBBLES AND BOULDERS (DENSE) COMPACTED FILL
17.3	98	26			5			
16.1	107	26						END OF COMPACTED FILL LAYER
12.1	105	10						
		50/3"			10			BOULDER
								▽ WATER LEVEL AT 1310 HOURS ON 9-5-75
								GRADES MEDIUM DENSE TO LOOSE
23.7	113	10			15			
20.2	86	12			20			
17.0	95	12			25			
20.2	84	20			30			BOULDER
18.9	107	34			35			
68.7	56	12			40		OH-GM	GREENISH GRAY ORGANIC SILT AND TUFF SAND AND GRAVEL (SOFT AND LOOSE)
52.7	69	34					CH-MH	GREENISH GRAY SILTY CLAY (STIFF)
41.9	76	59			45			BORING COMPLETED AT 45.0 FEET ON 9-5-75

LOG OF BORINGS

NOTES:

■ -DEPTH AT WHICH UNDISTURBED SAMPLE WAS TAKEN
⊠ -DEPTH AT WHICH DISTURBED SAMPLE WAS TAKEN
□ -DEPTH AT WHICH SAMPLE WAS LOST DURING EXTRACTION
I -DEPTH AND LENGTH OF CORE RUN
DRIVING ENERGY- 300 -LB WEIGHT DROPPING 30 INCHES

DAMES & MOORE

PLATE A-1B

466.12 (4-64)

FILE 8659-001
BY MD DATE 9-9-75
CHECKED BY MY DATE

REVISIONS
BY DATE
BY DATE
PLATE OF

BORING 3

SURFACE ELEVATION +15 FEET
MSL DATUM

Moisture Content in %	Dry Density in PCF	Blows/Ft. on Sampler	Core and % Recovery	Samples and/or Cores	Depth in Feet	Graph Symbol	Letter Symbol	Description
							GM	BROWN SILTY TUFF SAND AND GRAVEL (LOOSE), FILL
							GW-GP	BROWN SANDY TUFF GRAVEL, COBBLES AND BOULDERS (DENSE) COMPACTED FILL
		79/10"		■				
13.1	121	26		■	5			
		50/1"		■				END OF COMPACTED FILL LAYER
15.7	112	28		■	10			GRADES MEDIUM DENSE
								▽ WATER LEVEL AT 1150 HOURS ON 9-5-75
25.6	104	19		■	15			
19.5	106.5	14		■	20			
20.0	112	29		■	25			
21.5	112	18		■	30			
14.0	96	43		■	35			
		53/6"		■	40			
42.5	85	35		■			CH-MH	GREENISH GRAY SILTY CLAY (STIFF)
41.0	84	37		■	45			

BORING COMPLETED AT 46.5 FEET ON 9-8-75

LOG OF BORINGS

NOTES:

■ -DEPTH AT WHICH UNDISTURBED SAMPLE WAS TAKEN
⊠ -DEPTH AT WHICH DISTURBED SAMPLE WAS TAKEN
□ -DEPTH AT WHICH SAMPLE WAS LOST DURING EXTRACTION
I -DEPTH AND LENGTH OF CORE RUN
DRIVING ENERGY- 300 -LB WEIGHT DROPPING 30 INCHES

BARNES & MCDONNEL

PLATE A-IC

466.12 (4-64)

FILE 8569-001
BY AG DATE 9-24-75
CHECKED BY MY DATE

REVISIONS
BY DATE
BY DATE
PLATE OF

BORING 4

SURFACE ELEVATION +15 FEET
MSL DATUM

Moisture Content in %	Dry Density in PCF	Blows/Ft. on Sampler	Core and % Recovery	Samples and/or Cores	Depth in Feet	Graph Symbol	Letter Symbol	Description
							GM	BROWN SILTY TUFF GRAVEL (LOOSE), FILL
		27/4"		■			GW-GP	BROWN SANDY TUFF GRAVEL, COBBLES AND BOULDERS (DENSE) COMPACTED FILL
		35/6"		■	5			
12.7	112	30		■				
		15		■	10			END OF COMPACTED FILL LAYER
								GRADES MEDIUM DENSE
17.5	123	23		■	15			
		14		■	20			
		24		■	25			
19.3	110	31		■	30			
		20		■	35			
35.3	81	43		■				
26.7	102	25		■	40		GM-OH	GRAY ORGANIC SILT AND SAND AND GRAVEL (SOFT AND LOOSE)
							CH-MH	GREENISH GRAY SILTY CLAY (MEDIUM STIFF)
65.4	60	61/7"		■				

BORING COMPLETED AT 44.1 FEET ON 9-9-75

LOG OF BORINGS

NOTES:

■ -DEPTH AT WHICH UNDISTURBED SAMPLE WAS TAKEN
⊠ -DEPTH AT WHICH DISTURBED SAMPLE WAS TAKEN
□ -DEPTH AT WHICH SAMPLE WAS LOST DURING EXTRACTION
I -DEPTH AND LENGTH OF CORE RUN
DRIVING ENERGY- 300 -LB WEIGHT DROPPING 30 INCHES

PLATE A-ID

466.12 (4-64)

FILE 8659-001
BY AD DATE 9-24-75
CHECKED BY ____ DATE ____

REVISIONS
BY ____ DATE ____
BY ____ DATE ____
PLATE ____ OF ____

BORING 5

SURFACE ELEVATION +10 FEET
MSL DATUM

Moisture Content in %	Dry Density in PCF	Blows/Ft. on Sampler	Core and % Recovery	Samples and/or Cores	Depth in Feet	Graph Symbol	Letter Symbol	Description
							MH-GM	DARK BROWN GRAVELLY CLAYEY SILT (SOFT) (MIXTURE OF DRIED MUD AND TUFF FILL)
		44					GW-GP	BROWN SANDY TUFF GRAVEL, COBBLES AND BOULDERS (DENSE)
17.3	108	23			5			
17.7	108	31						▽ WATER LEVEL AT 1400 HOURS ON 9-10-75
		4						
					10		MH-OH	DARK GRAY ORGANIC CLAYEY SILT (VERY SOFT) (SMELLS OF METHANE GAS)
131.9	37	PUSH						
181.7	30	PUSH			15			
144.6	34	PUSH			20			
115.0	39	PUSH			25			
118.2	38	PUSH			30			
48.7	68	PUSH			35			
41.2	81	16					CH-MH	GREEN SILTY CLAY (MEDIUM STIFF TO STIFF)
38.9	83	60			40			GRADES VERY STIFF

BORING COMPLETED AT 41.5 FEET ON 9-9-75

LOG OF BORINGS

NOTES:

■ -DEPTH AT WHICH UNDISTURBED SAMPLE WAS TAKEN
⊠ -DEPTH AT WHICH DISTURBED SAMPLE WAS TAKEN
□ -DEPTH AT WHICH SAMPLE WAS LOST DURING EXTRACTION
I -DEPTH AND LENGTH OF CORE RUN
DRIVING ENERGY- 300 -LB WEIGHT DROPPING 30 INCHES

DAMES & MOORE

PLATE A-1E

466.12 (4-64)

FILE 8659-001
BY AD DATE 9.24.75
CHECKED BY MY DATE

REVISIONS
BY DATE
BY DATE
PLATE BY

BORING 6

SURFACE ELEVATION +10 FEET
MSL DATUM

Moisture Content in %	Dry Density in PCF	Blows/Ft. on Sampler	Core and % Recovery	Samples and/or Cores	Depth in Feet	Graph Symbol	Letter Symbol	Description
							GM	DARK BROWN SILTY GRAVEL (LOOSE), FILL
		68					GW-GP	BROWN SLIGHTLY SILTY SANDY TUFF GRAVEL, COBBLES AND BOULDERS (MEDIUM DENSE TO LOOSE), FILL
16.0	117	22			5			
		21						▽ WATER LEVEL AT 1400 HOURS ON 9-10-75
26.9	92	8			10			
		16		⊠	15			
13.6	100				20			
		20/6"			25		GM-OH	GRAY TUFF FRAGMENTS AND VOLCANIC CINDERS MIXED WITH VERY SOFT GREEN ORGANIC SILT (SOFT AND LOOSE)
50.9		6			30		MH-OH	GREENISH GRAY SANDY CLAYEY ORGANIC SILT (SOFT) (SMELLS OF METHANE GAS)
38.1	84	Push			35		CH-MH	GREEN SILTY CLAY (MEDIUM STIFF TO STIFF)
34.2	90	31			40			

BORING COMPLETED AT 40.5 FEET ON 9-10-75

LOG OF BORINGS

NOTES:

■ -DEPTH AT WHICH UNDISTURBED SAMPLE WAS TAKEN
⊠ -DEPTH AT WHICH DISTURBED SAMPLE WAS TAKEN
□ -DEPTH AT WHICH SAMPLE WAS LOST DURING EXTRACTION
I -DEPTH AND LENGTH OF CORE RUN
DRIVING ENERGY- 300 -LB WEIGHT DROPPING 30 INCHES

DAMES & MOORE

PLATE A-1F

466.12 (4-64)

FILE B659-001
BY AG DATE 10/16/75
CHECKED BY MV DATE

REVISIONS
BY DATE
BY DATE
PLATE OF

BORING 7

SURFACE ELEVATION 11 ± FEET
MSL DATUM

Moisture Content in %	Dry Density in PCF	Blows/Ft. on Sampler	Core and % Recovery	Samples and/or Cores	Depth in Feet	Graph Symbol	Letter Symbol	Description
							GW-GP	GRAY AND BROWN SLIGHTLY SILTY SANDY TUFF GRAVEL, COBBLES AND BOULDERS (MEDIUM DENSE TO LOOSE), FILL
16.1	112	28		■	5			
								▽ WATER LEVEL AT 0930 HOURS ON 10-10-75
					10			
19.5	103	17		■	15			
		6		□			GM-OH	GRAY TUFF FRAGMENTS AND BROWN ORGANIC SILT (SOFT AND LOOSE)
58.1	62	3		■	20		MH-OH	GREENISH GRAY ORGANIC SILT (SOFT)
134.2	43	2		■	25			
111.3	49	3		■	30			
64.9	59	17		■			CH-MH	GREEN SILTY CLAY (STIFF)
								BORING COMPLETED AT 34.5 FEET ON 10-10-75

LOG OF BORINGS

NOTES:

■ -DEPTH AT WHICH UNDISTURBED SAMPLE WAS TAKEN
⊠ -DEPTH AT WHICH DISTURBED SAMPLE WAS TAKEN
□ -DEPTH AT WHICH SAMPLE WAS LOST DURING EXTRACTION
I -DEPTH AND LENGTH OF CORE RUN
DRIVING ENERGY- 300 -LB WEIGHT DROPPING 30 INCHES

DAMES & MOORE

PLATE A-4G

466.12 (4-64)

FILE 8659-A01
BY DB DATE 10-16-75
CHECKED BY MY DATE

REVISIONS
BY DATE
BY DATE
PLATE OF

BORING 8

SURFACE ELEVATION 11 ± FEET
MSL DATUM

MOISTURE CONTENT IN %	DRY DENSITY IN PCF	BLOWS/FT. ON SAMPLER	CORE AND % RECOVERY	SAMPLES AND/OR CORES	DEPTH IN FEET	GRAPH SYMBOL	LETTER SYMBOL	DESCRIPTION
					0		GW-GP	GRAY SLIGHTLY SILTY SANDY TUFF GRAVEL, COBBLES AND BOULDERS (MEDIUM DENSE TO LOOSE), FILL
		55			5			
								▽ WATER LEVEL AT 1315 HOURS ON 10-10-75
					10			
		11						
					15			
		17						
22.2	103	11			20			
22.8	90	30			25			
		67						
		61			30			
75.0	57	15					CH-MH	GREEN SILTY CLAY (MEDIUM STIFF TO STIFF)
47.1	74	39			35			BORING COMPLETED AT 35.0 FEET ON 10-14-75

LOG OF BORINGS

NOTES:

■ -DEPTH AT WHICH UNDISTURBED SAMPLE WAS TAKEN
⊠ -DEPTH AT WHICH DISTURBED SAMPLE WAS TAKEN
□ -DEPTH AT WHICH SAMPLE WAS LOST DURING EXTRACTION
I -DEPTH AND LENGTH OF CORE RUN
DRIVING ENERGY- 300 -LB WEIGHT DROPPING 30 INCHES

DAMES & MOORE

PLATE A-1H

466.12 (4-64)

FILE 8659-001
BY AD DATE 10-16-75
CHECKED BY MV DATE

REVISIONS
BY DATE
BY DATE
PLATE OF

BORING 9

SURFACE ELEVATION 11 ± FEET
MSL DATUM

MOISTURE CONTENT IN %	DRY DENSITY IN PCF	BLOWS/FT. ON SAMPLER	CORE AND % RECOVERY	SAMPLES AND/OR CORES	DEPTH IN FEET	GRAPH SYMBOL	LETTER SYMBOL	DESCRIPTION
					0		GW GP-	GRAY SLIGHTLY SILTY SANDY TUFF GRAVEL, COBBLES AND BOULDERS (MEDIUM DENSE TO LOOSE), FILL
					5			
								▽ WATER LEVEL AT 1250 HOURS ON 10-14-75
					10			
		22			15			
					20			
		29						
26.0	96	24						
					25			
		23						
123.4	39	7			30		MH-OH	BLUE GREEN SLIGHTLY CLAYEY ORGANIC SILT (MEDIUM STIFF)
54.4	74	23					CH-MH	GREEN SILTY CLAY (STIFF)
								BORING COMPLETED AT 34.5 FEET ON 10-14-75

LOG OF BORINGS

NOTES:

■ -DEPTH AT WHICH UNDISTURBED SAMPLE WAS TAKEN
⊠ -DEPTH AT WHICH DISTURBED SAMPLE WAS TAKEN
□ -DEPTH AT WHICH SAMPLE WAS LOST DURING EXTRACTION
I -DEPTH AND LENGTH OF CORE RUN
DRIVING ENERGY- 300 -LB WEIGHT DROPPING 30 INCHES

DAMES & MOORE

PLATE A-11

SOIL CLASSIFICATION CHART

MAJOR DIVISIONS			GRAPH SYMBOL	LETTER SYMBOL	TYPICAL DESCRIPTIONS
COARSE GRAINED SOILS — MORE THAN 50 % OF MATERIAL IS LARGER THAN NO. 200 SIEVE SIZE	GRAVEL AND GRAVELLY SOILS — MORE THAN 50 % OF COARSE FRACTION RETAINED ON NO. 4 SIEVE	CLEAN GRAVELS (LITTLE OR NO FINES)		GW	WELL-GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES
				GP	POORLY-GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES
		GRAVELS WITH FINES (APPRECIABLE AMOUNT OF FINES)		GM	SILTY GRAVELS, GRAVEL-SAND-SILT MIXTURES
				GC	CLAYEY GRAVELS, GRAVEL-SAND-CLAY MIXTURES
	SAND AND SANDY SOILS — MORE THAN 50% OF COARSE FRACTION PASSING NO. 4 SIEVE	CLEAN SAND (LITTLE OR NO FINES)		SW	WELL-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
				SP	POORLY-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
		SANDS WITH FINES (APPRECIABLE AMOUNT OF FINES)		SM	SILTY SANDS, SAND-SILT MIXTURES
				SC	CLAYEY SANDS, SAND-CLAY MIXTURES
FINE GRAINED SOILS — MORE THAN 50 % OF MATERIAL IS SMALLER THAN NO. 200 SIEVE SIZE	SILTS AND CLAYS — LIQUID LIMIT LESS THAN 50			ML	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY
				CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
				OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
	SILTS AND CLAYS — LIQUID LIMIT GREATER THAN 50			MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SAND OR SILTY SOILS
				CH	INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS
				OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICTY, ORGANIC SILTS
HIGHLY ORGANIC SOILS				PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENTS

FOR LABORATORY CLASSIFICATION OF FINE-GRAINED SOILS

NOTES:

1. DUAL SYMBOLS ARE USED TO INDICATE BORDERLINE CLASSIFICATIONS.
2. WHEN SHOWN ON THE BORING LOGS, THE FOLLOWING TERMS ARE USED TO DESCRIBE THE CONSISTENCY OF COHESIVE SOILS AND THE RELATIVE COMPACTNESS OF COHESIONLESS SOILS.

COHESIVE SOILS	(APPROXIMATE SHEARING STRENGTH IN KSF)
VERY SOFT	LESS THAN .25
SOFT	0.25 TO 0.5
MEDIUM STIFF	0.5 TO 1.0
STIFF	1.0 TO 2.0
VERY STIFF	2.0 TO 4.0
HARD	GREATER THAN 4.0

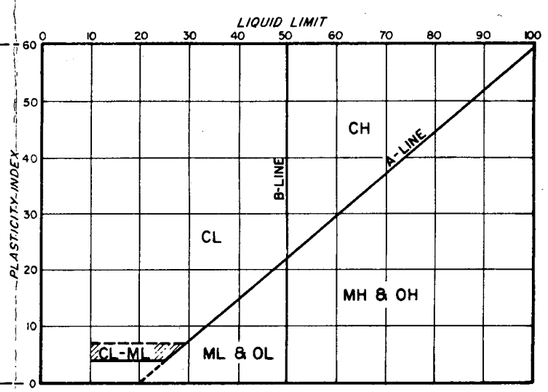
COHESIONLESS SOILS	
VERY LOOSE	THESE ARE USUALLY BASED ON AN EXAMINATION OF SOIL SAMPLES, PENETRATION RESISTANCE, AND SOIL DENSITY DATA.
LOOSE	
MEDIUM DENSE	
DENSE	
VERY DENSE	

GRADATION CHART

MATERIAL SIZE	PARTICLE SIZE			
	LOWER LIMIT		UPPER LIMIT	
	MILLIMETERS	SIEVE SIZE*	MILLIMETERS	SIEVE SIZE*
SAND				
FINE	.074	#200*	0.42	#40*
MEDIUM	0.42	#40*	2.00	#10*
COARSE	2.00	#10*	4.76	#4*
GRAVEL				
FINE	4.76	#4*	19.1	3/4"+
COARSE	19.1	3/4"+	76.2	3"+
COBBLES	76.2	3"+	304.8	12"+
BOULDERS	304.8	12"+	914.4	36"

*U.S. STANDARD +CLEAR SQUARE OPENINGS

PLASTICITY CHART



SAMPLES

- ■ INDICATES UNDISTURBED SAMPLE
- ⊠ INDICATES DISTURBED SAMPLE
- □ INDICATES SAMPLING ATTEMPT WITH NO RECOVERY
- I INDICATES LENGTH OF CORING RUN

NOTE:
DEFINITIONS OF ANY ADDITIONAL DATA REGARDING SAMPLES ARE ENTERED ON THE FIRST LOG ON WHICH THE DATA APPEAR.

UNIFIED SOIL CLASSIFICATION SYSTEM

DAMES & MOORE

PLATE A-2

746.2 (REV. 3-65)

BY AO DATE 9.30.75
CHECKED BY MY

FILE 8659-001

PRESSURE IN LBS. / SQ. FT.

100 200 300 400 500 1000 2000 3000 4000 5000 10000 20000 30000 40000 50000 102400

CONSOLIDATION IN INCHES / INCH

0.00 0.02 0.04 0.06 0.08 0.10 0.12 0.18 0.20

BORING 2, SAMPLE 10 AT 39.0 FEET
OH-MH

	BEFORE TEST	AFTER TEST
MOISTURE CONTENT	112.7%	89.0%
DRY DENSITY	44.7 PCF	50.8 PCF

PLATE A-3A

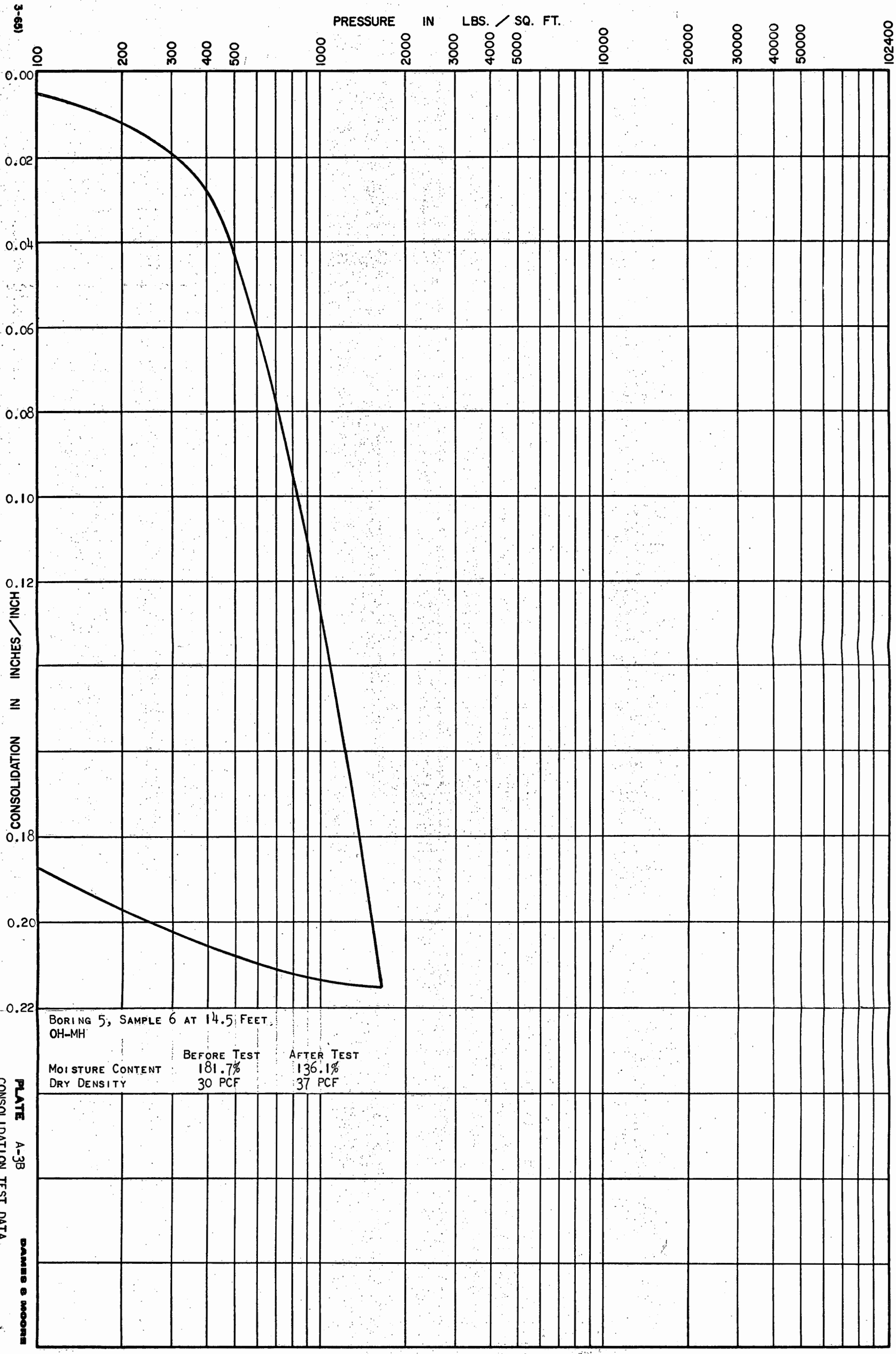
CONSOLIDATION TEST DATA

DAMES & MOORE

BY AO DATE 4-30-71

CHECKED BY MY

FILE B659-001



BORING 5, SAMPLE 6 AT 14.5 FEET.
OH-MH

	BEFORE TEST	AFTER TEST
MOISTURE CONTENT	181.7%	136.1%
DRY DENSITY	30 PCF	37 PCF

PLATE A-3B

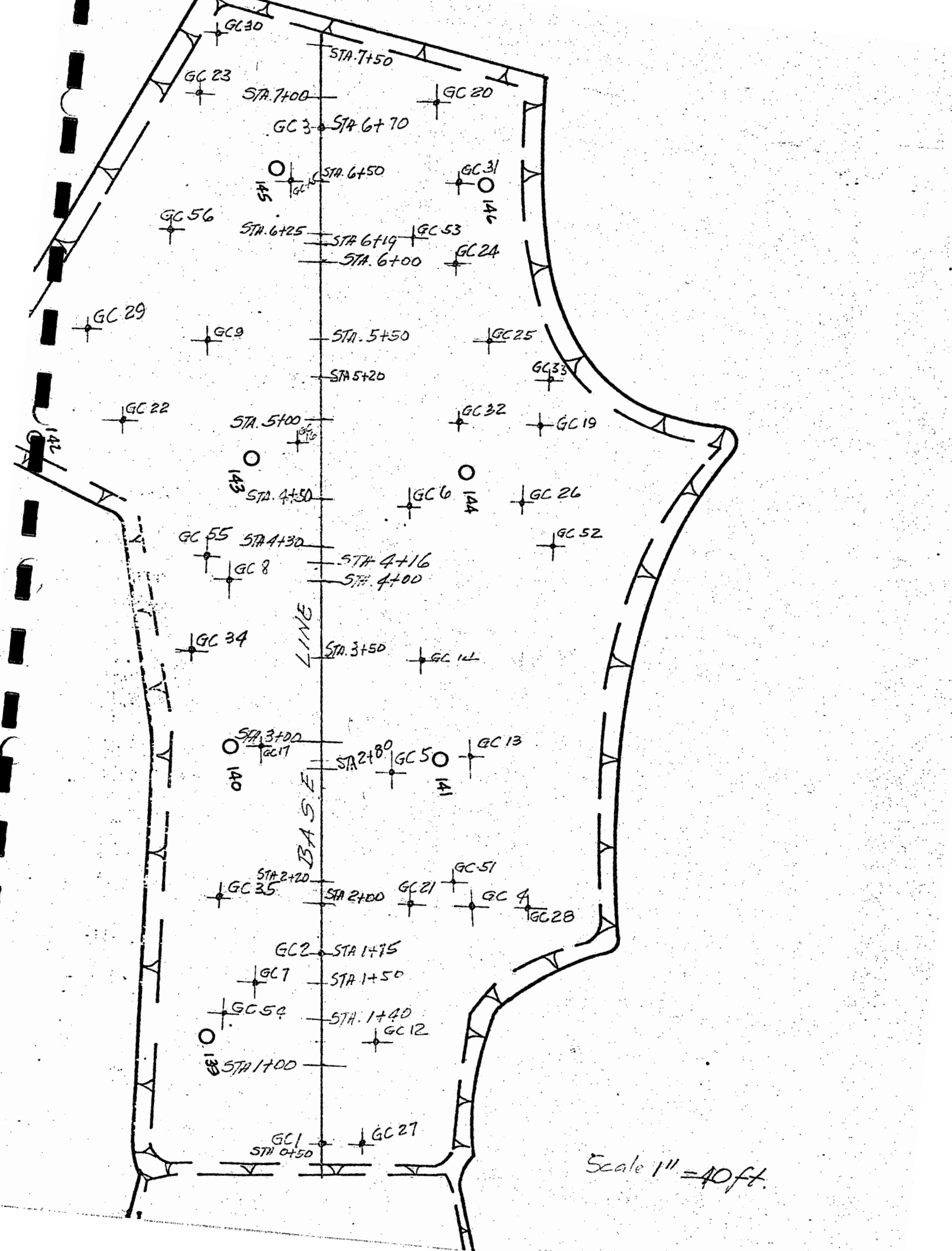
CONSOLIDATION TEST DATA

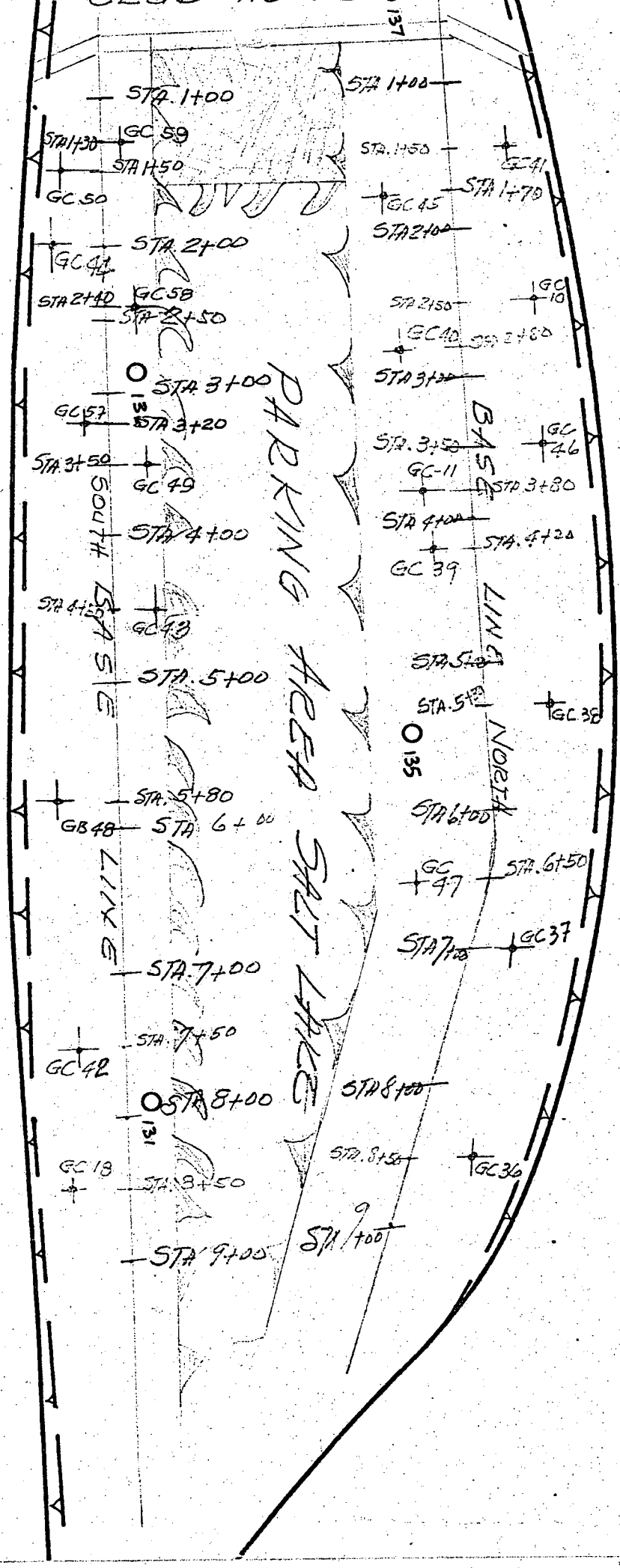
DAMES & MOORE

APPENDIX B

SUMMARY OF DENSITY TESTS

Sand replacement density test were performed during the construction of the proposed golf course clubhouse and parking lot areas in 1969. A summary of the test results and the location of the tests are shown on the following pages. These tests were performed in accordance with ASTM D1556-67 and ASTM D1557.


GC 30
STA. 7+50
GC 23
STA. 7+00
GC 20
GC 3
STA 6+70
STA. 6+50
GC 31
145
146
GC 56
STA. 6+25
STA 6+19
GC 53
STA. 6+00
GC 24
GC 29
GC 9
STA. 5+50
GC 25
STA 5+20
GC 33
GC 22
STA. 5+00
GC 32
GC 19
142
143
STA. 4+50
GC 6
144
GC 26
GC 55
STA 4+30
GC 52
GC 8
STA 4+16
STA. 4+00
LINE
GC 34
STA. 3+50
GC 14
STA 3+00
GC 17
140
STA 2+80
GC 5
GC 13
141
BASE
STA 2+20
GC 51
GC 35
STA 2+00
GC 21
GC 4
GC 28
GC 2
STA 1+75
GC 7
STA 1+50
GC 54
STA. 1+40
GC 12
139
STA 1+00
GC 1
STA 0+50
GC 27
Scale 1" = 40 ft.


STA. 1+00
STA 1+30
GC 59
STA 1+50
GC 50
STA 2+00
GC 41
STA 2+40
GC 58
STA 2+50
STA 3+00
135
GC 57
STA 3+20
STA 3+50
GC 49
STA 4+00
STA 4+50
GC 48
STA. 5+00
STA. 5+80
GB 48
STA 6+00
STA. 7+00
STA. 7+50
GC 42
STA 8+00
131
GC 18
STA. 8+50
STA 9+00
PARKING AREA
SOUTH
SALT LAKE
STA 1+00
STA. 1+50
GC 41
GC 45
STA 1+70
STA 2+00
STA 2+50
GC 10
GC 40
STA 2+80
STA 3+00
BASS
STA. 3+50
GC 46
GC-11
STA 3+80
STA 4+00
STA. 4+20
GC 39
LINN
STA. 5+00
STA. 5+50
GC 38
135
NORTH
STA 6+00
GC 47
STA. 6+50
STA 7+00
GC 37
STA 8+00
STA. 8+50
GC 36
STA 9+00

Scale 1" = 40 ft

SUMMARY OF DENSITY TESTS
CONTROL OF COMPACTED FILL

JOB NO. 4427-010 | OWNER INT. DEVELOPMENT CO

PAGE 1 OF 3 | JOB ENGR.

TEST NO.	DATE	TEST LOCATION	ELEV FT.	% COMP REQ'D	MAX DRY DENSITY P.C.F.	FILL MOISTURE %	TEST DRY DENSITY P.C.F.	% MAX DRY DENSITY	REMARKS
GC 1	5/12/69	50' from STA 0+00	A.W.T. +5	90	113	16.	102.5	90.8	Above Working Elev. TABLE o/c
GC 2	5/12/69	75' from STA. 0+00	A.W.T. +4'	90	113	17.5	102.	90.5	Elev. Above Work TABLE o/c
GC 3	5/12/69	70' from STA. 6+00	A.W.T. +3	90	113	23.2	100.5	89.	Failed
GC 4	5/13/69	40' R of STA 2+00	A.W.T. +5'	90	113	19.0	103.5	92	A.W.T. (Above Work TABLE) o/c
GC 5	5/13/69	22' R of STA 2+80	A.W.T. +3.5	90	113	16.3	105.	93	o/c
GC 6	5/13/69	34' R of STA. 4+50	A.W.T. +2.5	90	113	18.0	101.5	89.6	Failed
GC 7	5/13/69	37' L of STA 1+50	+5'	90	113	21.0	103.5	92	o/c
GC 8	5/13/69	43' L of STA. 4+00	+4'	90	113	19.5	104.5	93	o/c
GC 9	5/13/69	46' L of STA. 5+50	+3	90	113	20.7	103.5	92	o/c
GC 10	5/14/69	19' R of STA 2+50 N-DIKE	+6.5	90	113	19.3	103	91.5	o/c
GC 11	5/14/69	16' L of STA 3+80	+3	90	113	21.2	104	92	o/c
EB 247	5/15/69	Lot #67 Unit 6A	(00)	90	113	19.4	105	93	o/c
EB 248	5/15/69	Lot #66 Unit 6A	(00)	90	113	19.6	105.4	93.5	o/c
GC 12	5/18/69	25' R of STA 1+20	+13	90	113	17.2	106.5	94.5	o/c
GC 13	5/18/69	80' R of STA. 2+80	+13	90	113	20.3	103.	91.5	o/c
GC 14	5/18/69	64' R of STA. 3+50	+13	90	113	20.1	103.5	92.	o/c
GC 15	5/19/69	20' L of STA. 6+50	+14	90	113	22.2	103.2	92	o/c
GC 16	5/19/69	31' L of STA 4+80	+14	90	113	18.8	106.	94	o/c
GC 17	5/19/69	28' L of STA 3+00	+14	90	113	16.8	108.	95.5	o/c
GC 18	5/20/69	20' L of STA. 8+50 S-DIKE	+8	90	113	20.8	103.5	92.	o/c
GC 19	5/20/69	200' L of STA. 5+00	+14	90	113	18.0	106.	94	o/c
GC 20	5/20/69	64' L of STA 7+00	+14	90	113	19.7	105.	93	o/c
GC 21	5/22/69	52' R of STA 2+00	+15	90	113	18.6	105.5	93.5	o/c
GC 22	5/22/69	70' L of STA. 5+00	+15	90	113	14.4	109	96.5	o/c
GC 23	5/23/69	67' L of STA 7+00	+15	90	113	15.0	108.5	96.	o/c
GC 24	5/22/69	62' R of STA. 6+00	+16	90	113	18.2	105.5	93.5	o/c

SUMMARY OF DENSITY TESTS
CONTROL OF COMPACTED FILL

JOB NO. 4427-010 | OWNER INT. DEVELOPMENT CO.

 | JOB ENGR.

TEST NO.	DATE	TEST LOCATION	ELEV FT.	% COMP REQ'D	MAX DRY DENSITY P.C.F.	FILL MOISTURE %	TEST DRY DENSITY P.C.F.	% MAX DRY DENSITY	REMARKS
GC25	5/22/69	68'R of STA. 5+50	+16	90	113	18.5	106.5	94.5	ok
GC26	5/22/69	82'R of STA. 4+50	+16	90	113	17.8	107.6	95.5	ok
GC27	5/26/69	20'R of STA. 0+50	+17	90	113	23.2	102.5	91.	ok
GC28	5/26/69	62'R of STA. 2+00	+17	90	113	16.0	108.5	96.5	ok
GC29	5/26/69	118'L of STA. 5+50	+17	90	113	17.3	107.0	95.	ok
GC30	5/26/69	73'L of STA 7+50	+17	90	113	17.7	107.0	95	ok
GC31	5/26/69	70'R of STA. 6+50	+17	90	113	16.7	108.5	96	ok
GC32	5/26/69	64'R of STA. 5+00	+17	90	113	15.2	109.5	97	ok
GC33	5/27/69	134'R of STA. 5+20	+17	90	113	22.	103.5	92	ok
GC34	5/27/69	76'L of STA 3+50	+17	90	113	16.6	107.5	95	ok
GC35	5/27/69	73'L of STA 2+00	+17	90	113	21.2	104.5	93	ok
GC36	5/29/69	N-DIKE 20'R of STA 8+50	+9	90	113	19.6	105.5	93.5	ok
GC37	5/29/69	N-DIKE 16'R of STA. 7+00	+10	90	113	18.4	107.	95.	ok
GC38	5/29/69	N-DIKE 19'R of STA. 5+30	+11	90	113	16.6	108.5	96.	ok
GC39	5/29/69	N-DIKE 10'L of STA. 4+20	+12	90	113	18.6	105.2	93.5	ok
GC40	5/29/69	16'L of STA. 2+80	+12	90	113	20.4	104.5	92.5	ok
GC41	5/29/69	13'R of STA. 1+50	+12	90	113	16.0	107.6	95.5	ok
GC42	6/3/69	S-DIKE 16'L of STA. 7+50	+11	90	113	19.0	106.	94.	ok
GC43	6/3/69	S-DIKE 10'R of STA. 4+50	+12	90	113	19.5	106.3	94.5	ok
GC44	6/3/69	S-DIKE 13'L of STA. 2+00	+13	90	113	21.6	105.	93	ok
GC45	6/4/69	N-DIKE 16'L of STA. 1+70	+14	90	113	22.4	103	91.5	ok
GC46	6/4/69	N-DIKE 13'R of STA 3+50	+14	90	113	22.0	104	92.5	ok
GC47	6/4/69	N-DIKE 17'L of STA. 6+50	+14	90	113	21.2	105.	93	ok
GC48	6/5/69	S-DIKE 13'L of STA 5+80	+13	90	113	21.2	103.5	92	ok
GC49	6/5/69	S-DIKE 7'R of STA. 3+50	+13	90	113	21.4	103.5	92.	ok
GC50	6/5/69	S-DIKE 10'L of STA. 1+50	+13	90	113	22.2	104.0	92.5	ok

SUMMARY OF DENSITY TESTS
CONTROL OF COMPACTED FILL

JOB NO. 4427-010 | OWNER INT. DEVELOPMENT CO.

PAGE 3 OF 3 | JOB ENGR.

TEST NO.	DATE	TEST LOCATION	ELEV FT.	% COMP REQ'D	MAX DRY DENSITY P.C.F.	FILL MOISTURE %	TEST DRY DENSITY P.C.F.	% MAX DRY DENSITY	REMARKS
C 51	6/10/69	CLUB HOUSE, 116' R of STA. 2+20	+17	90	113	22.6	103.5	92	ok
C 52	6/10/69	CLUB HOUSE 200' R of STA 4+30	+17	90	113	22.8	104.0	92.5	ok
C 53	6/10/69	CLUB HOUSE 80 R of STA 6+25	+17	90	113	22.6	103.5	92.	ok
C 54	6/12/69	CLUB HOUSE 85' L of STA. 1+40	+17	90	113	23.0	103.0	91.	ok
C 55	6/12/69	CLUB HOUSE 100 L of STA. 4+16	+17	90	113	22.0	104.0	92.5	ok
C 56	6/12/69	130' L of STA. 6+19	+17	90	113	23.7	104.0	92.5	ok
C 57	6/16/69	S-DIKE 16' L of STA. 3+20	+13	90	113	22.8	103.0	91.5	ok
C 58	6/16/69	S-DIKE 19' R of STA. 2+40	+13	90	113	22.0	103.0	91.5	ok
C 59	6/16/69	10' R of STA. 1+30	+13	90	113	22.4	103.1	91.6	ok

APPENDIX C

LETTER NO. 161

SUMMARY OF SETTLEMENT OBSERVATION

Settlement gages were placed in the proposed parking lot and clubhouse sites to monitor the fill settlements. Letter No. 161 which summarizes the observed settlement is contained in this appendix. The actual records are not included due to their voluminous size. These records are kept in our office for review if necessary.

ANCHORAGE
ATLANTA
BETHESDA
BILLINGS
BOCA RATON
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CHICAGO
CINCINNATI
CRANFORD
DENVER
FAIRBANKS
HONOLULU
HOUSTON
LOS ANGELES
NEW ORLEANS
NEW YORK
PHOENIX
PORTLAND
SALT LAKE CITY
SAN FRANCISCO
SANTA BARBARA
SEATTLE
SYRACUSE
WASHINGTON, D.C.
WHITE PLAINS

DAMES & MOORE
CONSULTANTS IN THE ENVIRONMENTAL AND APPLIED EARTH SCIENCES

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CABLE: DAMEMORE

January 25, 1971

Sunn, Low, Tom & Hara, Inc.
1000 Bishop Street
7th Floor
Honolulu, Hawaii 96813

Attention: Mr. James S. Hara

Gentlemen:

Letter No. 161
Summary of Settlement Observations
Clubhouse and Golf Course Parking Areas
Moanalua, Oahu, Hawaii
for International Development Company

This letter is written to advise you of our current settlement observations for constructed fill in the clubhouse and golf course parking areas located in the northern end of the East Bank development.

The amount of settlement that has occurred to date in the above areas is briefly summarized on the attached Table I. The locations of the settlement gages are shown on the attached Plate I. Detailed records of several representative gages in the clubhouse and parking areas were previously presented in our letter No. 160, dated September 4, 1970. These records are updated on the attached Plates 2A through 2C, 3A through 3C, 4A through 4C and 5. The detailed records attached to this letter also include readings from gage number 147, which was installed in September, 1970.

In our letter No. 160, we acknowledged the completion of consolidation in all of the areas located near Base Line C in the East Bank development. Based on the results of settlement data received since last September and our field observations, we believe that consolidation is also essentially completed in the clubhouse fill, including the surcharged peripheral area. We, therefore, suggest that readings from gages 139 through 144 in the clubhouse area be discontinued.

Considerable settlement is still occurring in the east-central portion of the parking area as evidenced by recent readings from gage 147. The settlement is reflected to a lesser degree by the other gages located nearer the outer margin of the fill. Because of the continued settlement in the parking area fill, we recommend that readings from gages 131, 135, 137 and 147 be continued at two-week intervals until further notice.

Thank you for your continued cooperation and assistance.

Yours very truly,

DAMES & MOORE

David C. Liu

DCL RJW mew

Attachments: Table 1, Summary of Settlement Data
Plate 1, Location of Settlement Gages,
Proposed Clubhouse Facilities
Proposed Parking Area
Plate 2A - 2C, Settlement Gage 131
Plate 3A - 3C, Settlement Gage 139
Plate 4A - 4C, Settlement Gage 144
Plate 5, Settlement Gage 147

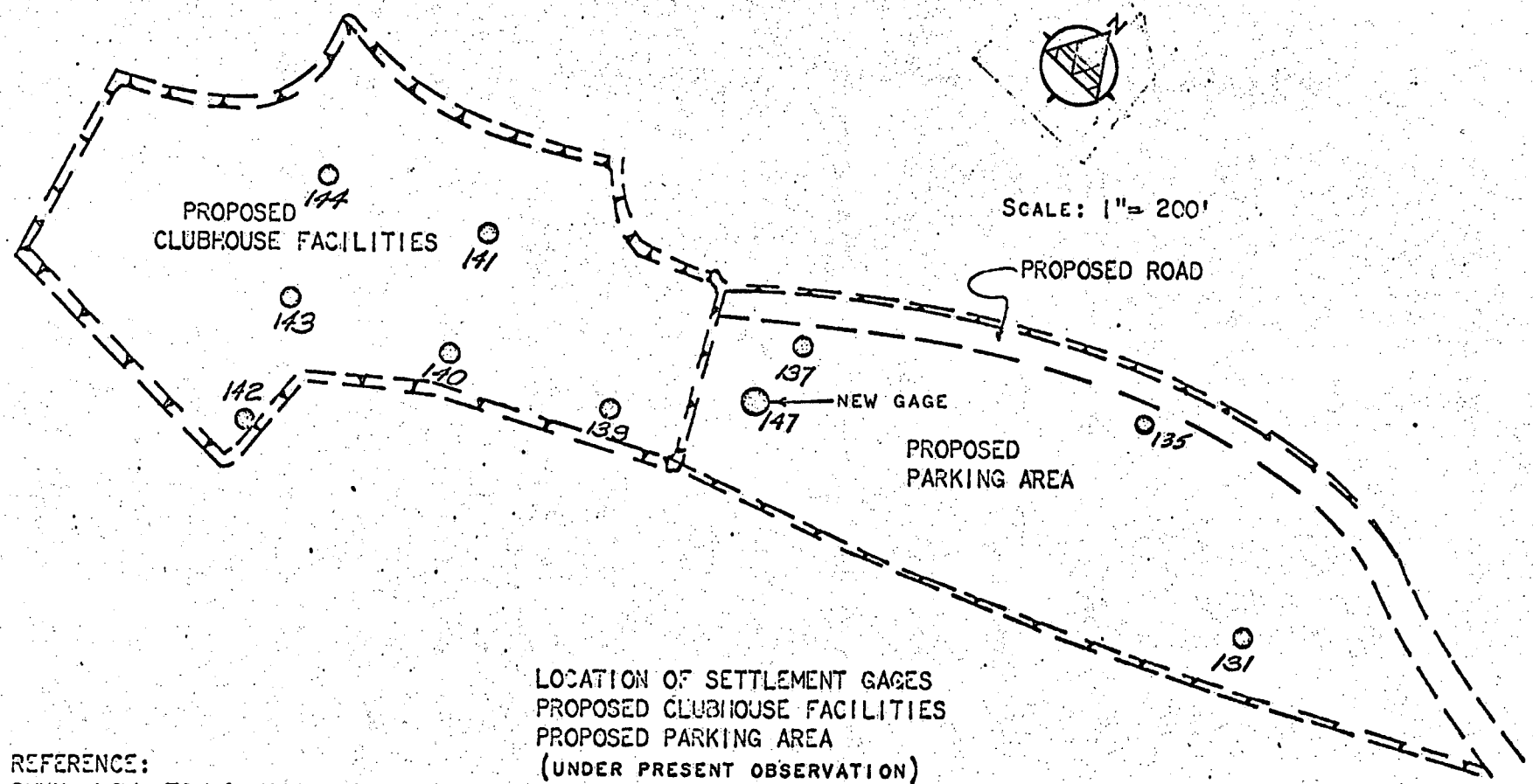
TABLE I

SUMMARY OF SETTLEMENT DATA

Settlement Gage Number	Total Settlement as of 1/07/71 (inches)	Recommended Interval of Readings as of 8/12/70	Location
131	4.6	two weeks	Parking Area
135	3.7	two weeks	Parking Area
137	6.7	two weeks	Parking Area
139	4.0	terminate	Clubhouse
140	3.8	terminate	Clubhouse
141*	3.5	terminate	Clubhouse
142	5.3	terminate	Clubhouse
143	2.9	terminate	Clubhouse
144	3.2	terminate	Clubhouse
147**	4.0	two weeks	Parking Area

*Previously reported settlement of 3.9inches as of 8/12/70 was slightly in error. The current settlement was 3.4 inches.

**Installed 8/17/70



LOCATION OF SETTLEMENT GAGES
PROPOSED CLUBHOUSE FACILITIES
PROPOSED PARKING AREA
(UNDER PRESENT OBSERVATION)

REFERENCE:
SUNN, LOW, TOM & HARA INC.
GOLF COURSE GRADING PLAN
LAKESIDE DEVELOPMENT
MOANALUA, HONOLULU, OAHU, HAWAII

LEGEND:
O LOCATION OF SETTLEMENT GAGES
131 GAGE NUMBER

BARNES & MOORE

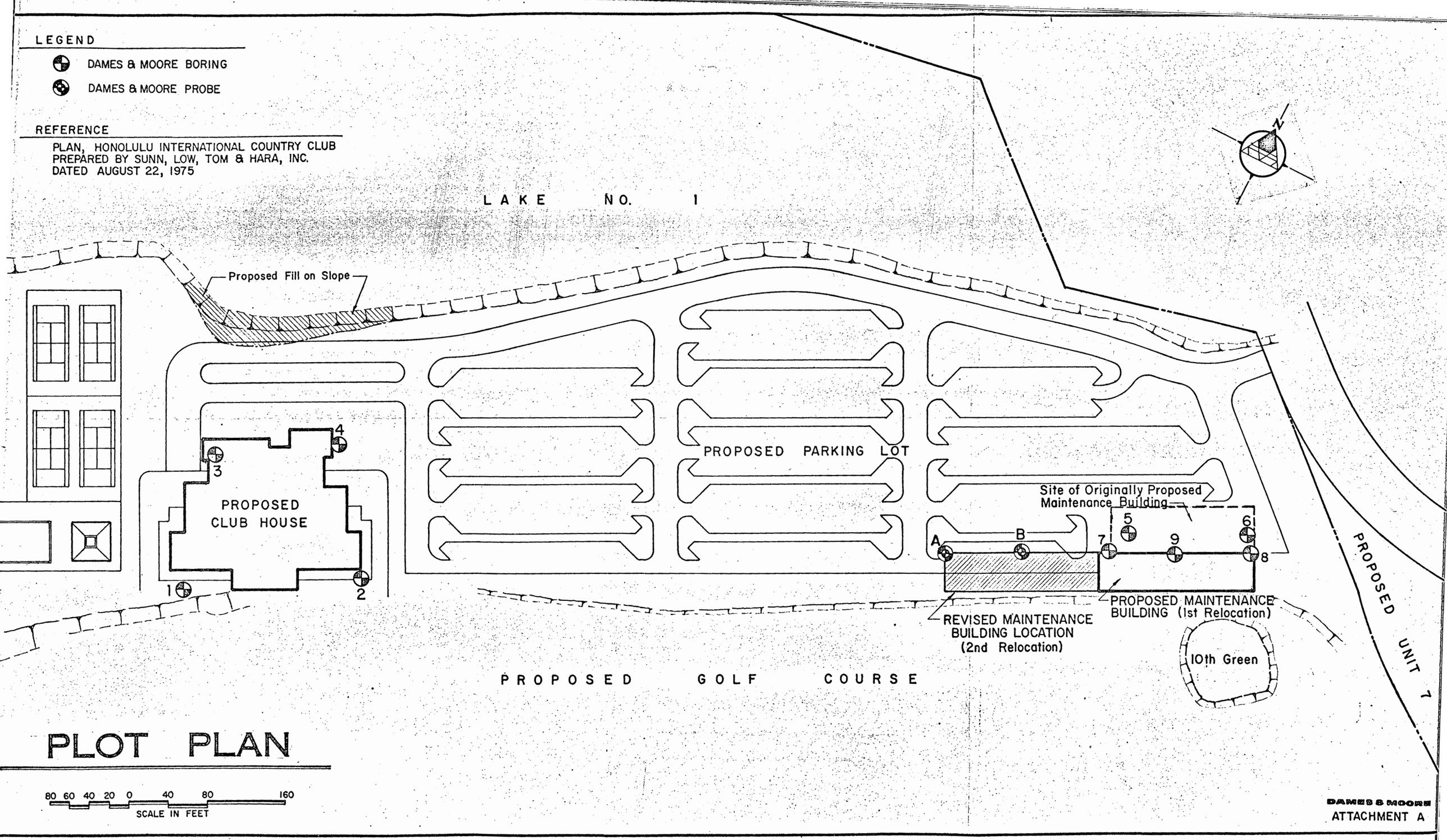
PLATE 1

LEGEND

- DAMES & MOORE BORING
- DAMES & MOORE PROBE

REFERENCE

PLAN, HONOLULU INTERNATIONAL COUNTRY CLUB
PREPARED BY SUNN, LOW, TOM & HARA, INC.
DATED AUGUST 22, 1975



PLOT PLAN

80 60 40 20 0 40 80 160
SCALE IN FEET

DAMES & MOORE
ATTACHMENT A